AD-A052 676 B-K DYNAMICS INC ROCKVILLE MD F/G 9/2

SUMMARY REPORT OF STINGER CONVERSION ACTIVITIES. (U)

JUL 76 DAAH01-75-C-0194

UNCLASSIFIED BKD-TR-3-206 NL

1 OF 4

AD A052676

AD A052676

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(14) BKD-TR-3-206

(6) SUMMARY REPORT OF STINGER CONVERSION ACTIVITIES.

(15) DAAH01-75-C-0194 new

(11) 31 Jul[redacted]976

(12) 32p.

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Rockville, Md.

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I. INTRODUCTION

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I. INTRODUCTION

This report contains selected documentation of the MICOM real-time STINGER simulation. Sections II and III describe the MAIN program which serves as a driver for pre- and post-real-time computation, respectively. Other codes which support these computations are presented in Sections VI, VII, VIII, IX. The real-time computations are performed by Subroutines FLIGHT and REALT which are documented in Section IV. The interconnection of various computation elements is described in Section V which is titled Real-Time I/O.

In Appendix A the aforementioned code is presented. Then, in Appendix B a restructured version is given. The restructured documentation can be of considerable value. However, this value will only be realized from future development.

II. PROGRAM MAIN (PRE-REAL-TIME)

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II. PROGRAM MAIN (Pre-Real-Time)

Program MAIN provides both pre- and post-real-time functions. However, for purpose of documentation, program MAIN will be treated as two separate pieces of code dealing with pre- and post-real-time functions. In this section, pre-real-time computations performed by program MAIN are documented. Portions of program MAIN not included in this section are discussed in the next section.

Functionally, program MAIN serves to connect on a macroscopic level several physically separateable modules of code. In some cases however, computer implementation does not lead to a strictly modular code. Therefore, some portions of program MAIN involve the micro-codes which are, in concept, portions of other major modules.

Non-real time data input to the STINGER digital computer program is organized into three distinct levels. These three levels of data input are related to frequency of data change during normal simulation activities. Specifically, data can be input to the program in the following ways.

- Data card or DDS commands
- Block Data
- Inline computer code

Data input via block data or inline computer code requires careful attention to the particular code affected. Pre-programmed diagnostics and informative printout will not generally reveal errors in such modifications.

More information concerning pre-real time data processing is contained in the Sections titled SUBROUTINE KSCALE, INIT, and GUID.

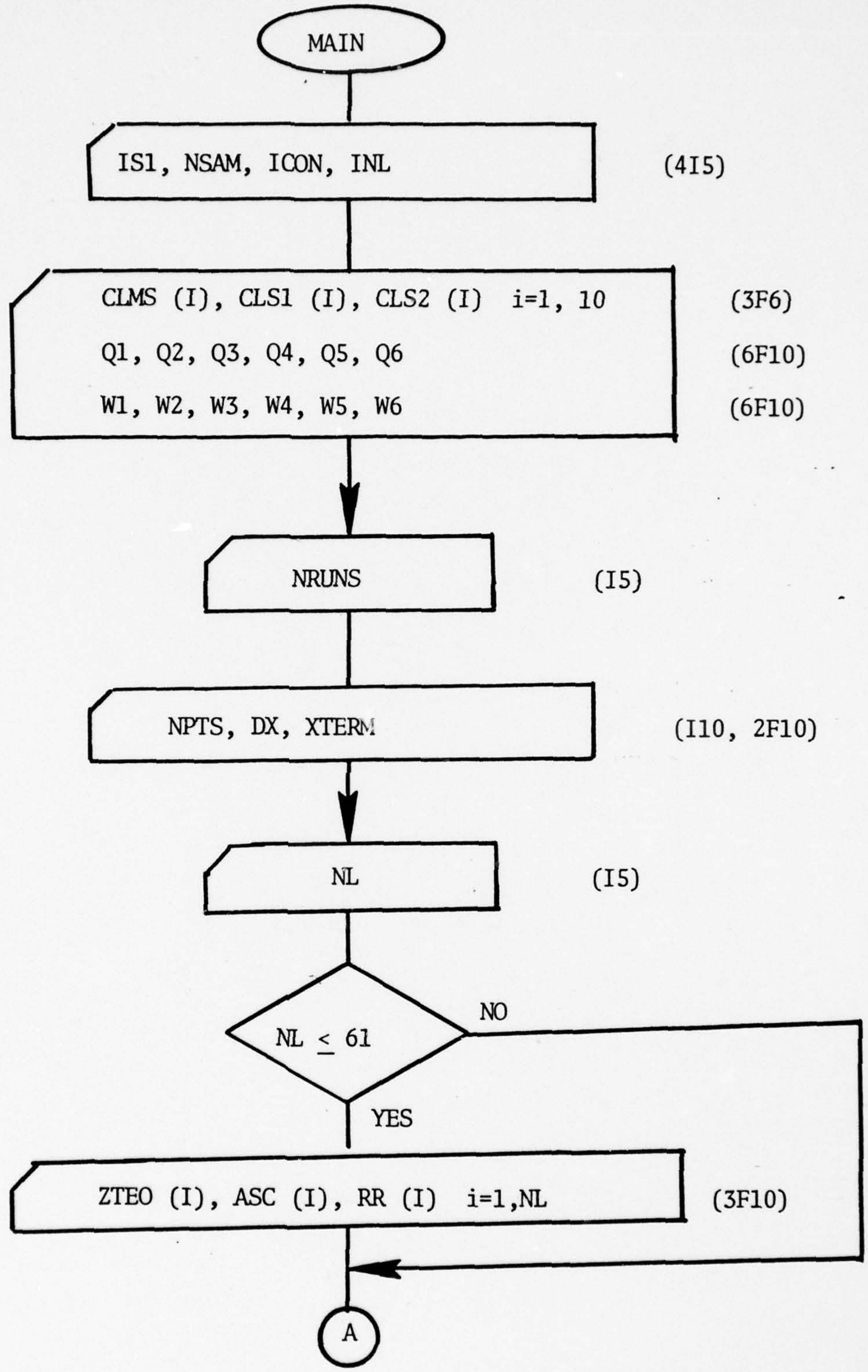
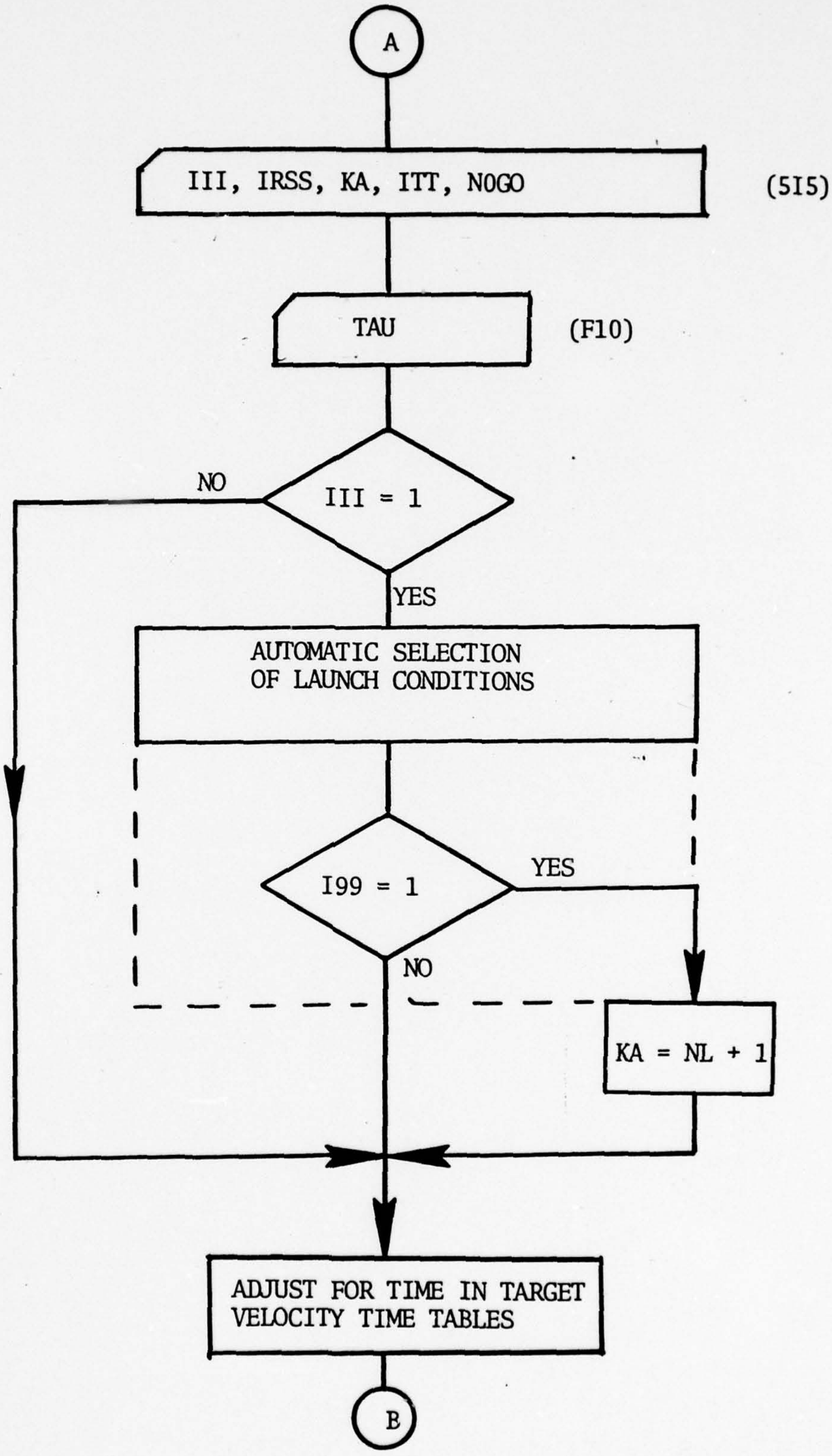
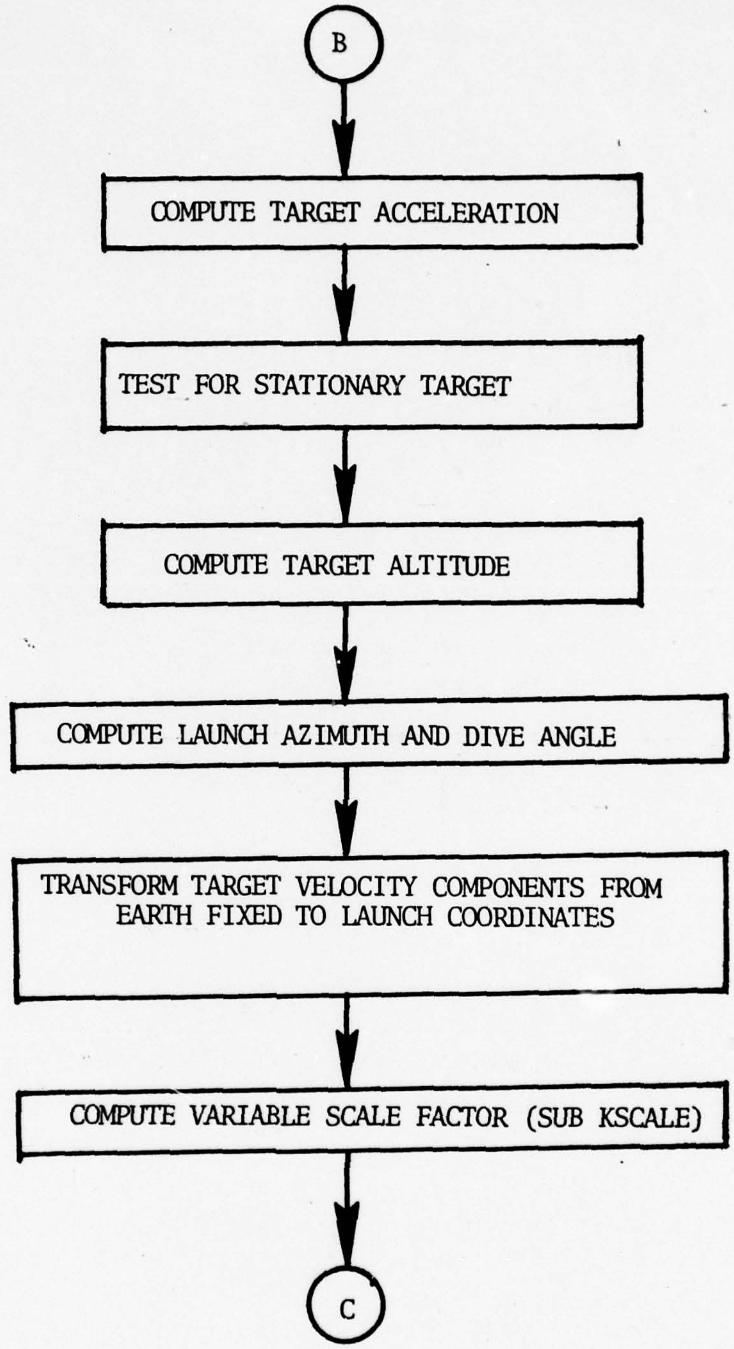
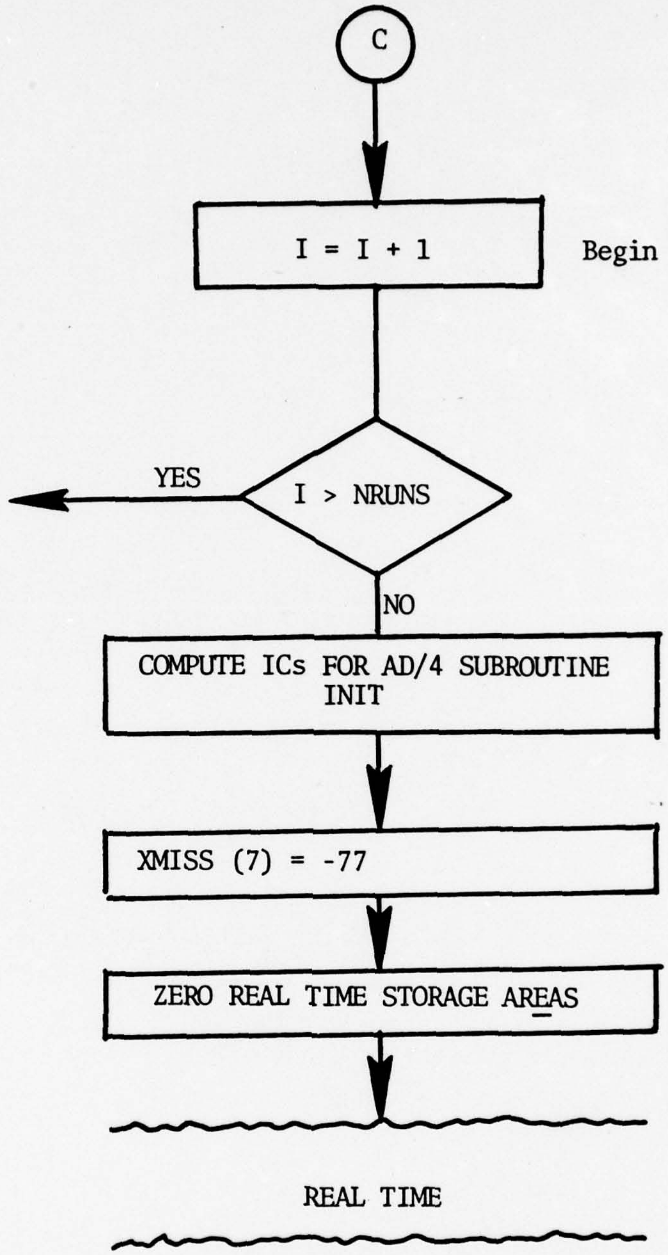


FIGURE 2.1 DATA CARD OR DDS DATA INPUT


A
III, IRSS, KA, ITT, NOGO
(5I5)
TAU
(F10)
III = 1
NO
YES
AUTOMATIC SELECTION OF LAUNCH CONDITIONS
I99 = 1
YES
NO
KA = NL + 1
ADJUST FOR TIME IN TARGET VELOCITY TIME TABLES
B


B
COMPUTE TARGET ACCELERATION
TEST FOR STATIONARY TARGET
COMPUTE TARGET ALTITUDE
COMPUTE LAUNCH AZIMUTH AND DIVE ANGLE
TRANSFORM TARGET VELOCITY COMPONENTS FROM EARTH FIXED TO LAUNCH COORDINATES
COMPUTE VARIABLE SCALE FACTOR (SUB KSCALE)
C



Begin counting repeat run

TARGET ACCELERATION

$$\ddot{X}_{TE}(i) = \dot{X}_{TE}(i+1) - \dot{X}_{TE}(i), \; i = 1, 27$$

$$\ddot{Y}_{TE}(i) = \dot{Y}_{TE}(i+1) - \dot{Y}_{TE}(i), \; i = 1, 27$$

$$\ddot{Z}_{TE}(i) = \dot{Z}_{TE}(i+1) - \dot{Y}_{TE}(i), \; i = 1, 27$$

NOTE: ΔT, the time between samples in the target velocity tables, is assumed to be one second.

TEST FOR STATIONARY TARGETS

$$VVVV = \sqrt{\dot{X}^2_{TE}(0) + \dot{Y}^2_{TE}(0) + \dot{Z}^2_{TE}(0)}$$

VVVV > 338 FT/SEC → moving target

VVVV < 338 FT/SEC → stationary target

TARGET ALTITUDE

$$h_{asL} = h + \Delta h$$

where Δh is altitude of launch point above sea level

ADJUSTMENT FOR TIME IN TARGET VELOCITY - TIME MANEUVER TABLES

Target velocity-time maneuver tables are shifted in time by the parameter TAU. Setting TAU to a positive real value causes the target trajectory time = TAU and real time = 0 to coincide. Therefore the portion of the target maneuver tables between time = 0 and time = TAU is disregarded. The end of the target maneuver tables is filled with a constant velocity maneuver, i.e., the portion of the trajectory between time = 27-TAU and time = 27 seconds. For TAU = 0 there is no shift in the target velocity - time maneuver tables.

EXAMPLE: TAU = 2.5

TM(I)	XDEM(J,ITT)	TMA(I)	XDM(I)	
0	XDEM(1,ITT)	-.5	XDEM(3,ITT)	← t = 0
1	XDEM(2,ITT)	.5	XDEM(4,ITT)	
2	XDEM(3,ITT)	1.5	XDEM(5,ITT)	
.	.	.	.	
.	.	.	.	
.	.	.	.	
23	XDEM(23,ITT)	22.5	XDEM(26,ITT)	
24	XDEM(24,ITT)	23.5	XDEM(26,ITT)	
25	XDEM(25,ITT)	25.0	XDEM(26,ITT)	
26	XDEM(26,ITT)	26.0	XDEM(26,ITT)	

LAUNCH AZIMUTH AND DIVE ANGLE

Calculation of launch angle and dive angle are based upon the following definitions and conventions:

$\overline{V}$ - Projection of target initial velocity vector on to the X_E - Y_E plane
$\overline{W}$ - Projection of initial $\overline{L}_{os}$ vector in the X_E - Y_E plane
β - Angle from positive X_E - axis to $\overline{V}$ (positive clockwise)
Σ_0- Crossing angle = angle from $\overline{V}$ to $\overline{W}$ (positive clockwise)
ψ_L- The angle from positive X_E - axis to the vector from the origin to target (note this is just $-\overline{W}$)

From the above definitions $\Sigma_0 + \beta$ is the angle from positive X_E - axis to vector $\overline{W}$. Then, since $-\overline{W}$ is in opposite direction from $\overline{W}$, the angle ψ_L differs from $\Sigma_0 + \beta$ by 180 degrees. Therefore

$$\psi_L = \Sigma_0 + \beta \pm 180^\circ$$

Here ψ_L is chosen base on whichever sign yields a positive value.

Based upon the value of $\dot{X}_{TE}(0)$ and $\dot{Y}_{TE}(0)$ the value of $\psi_L(0)$ is determined via four special computational rules. Note that the case $X_{TL}(0) \neq 0$ and $Y_{TL}(0) = 0$ is excluded from consideration and should not appear in candidate trajectories. The four computational rules as they are categorized in the computer code are:

CASE 1

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$
0	>0

$$\beta = \tan^{-1} (X_{TE}(0)/Y_{TE}(0))$$

$\psi_L = \Sigma_0 + \beta - 180^\circ$, $\psi_L(0)$ is determined by whichever

$\Sigma_0 + \beta + 180^\circ$ quantity is positive

SEO = (see computation in Subroutine INIT)

CASE 2

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$
0	>0

$\beta = 90^{\circ}$

$\psi_L(0) = \Sigma_0 + \beta - 180^{\circ}$, $\psi_L(0)$ is determined by whichever

$\Sigma_0 + \beta + 180^{\circ}$ quantity is positive

SEO = (see computation in Subroutine INIT)

CASE 3

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$	
>0	>0	
>0	<0	
<0	>0	
<0	<0	}Computer implementation does not take care of this case

$\beta = 270^{\circ}$

$\psi_L(0) = \Sigma_0 + \beta - 180^{\circ}$ $\psi_L(0)$ is determined by whichever

$\Sigma_0 + \beta + 180^{\circ}$ quantity is positive

SEO = (see computation in Subroutine INIT)

CASE 4

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$	and $Z_{TE}(0) = 0$
0	0	
>0	0}	Computer implementation does not take
>0	0}	care of these two cases

$\psi_L(0) = 0$ For stationary target crossing angle

SEO = 0 is not applicable, program sets KKK = 1

CASE 4b

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$
0	0
>0	0}Computer implementation does not
<0	0}take care of these two cases

$\psi_L(0) = 0$

$SEO = 90^{\circ}$

For vertical target trajectory crossing angle is not applicable, program sets KKK = 1

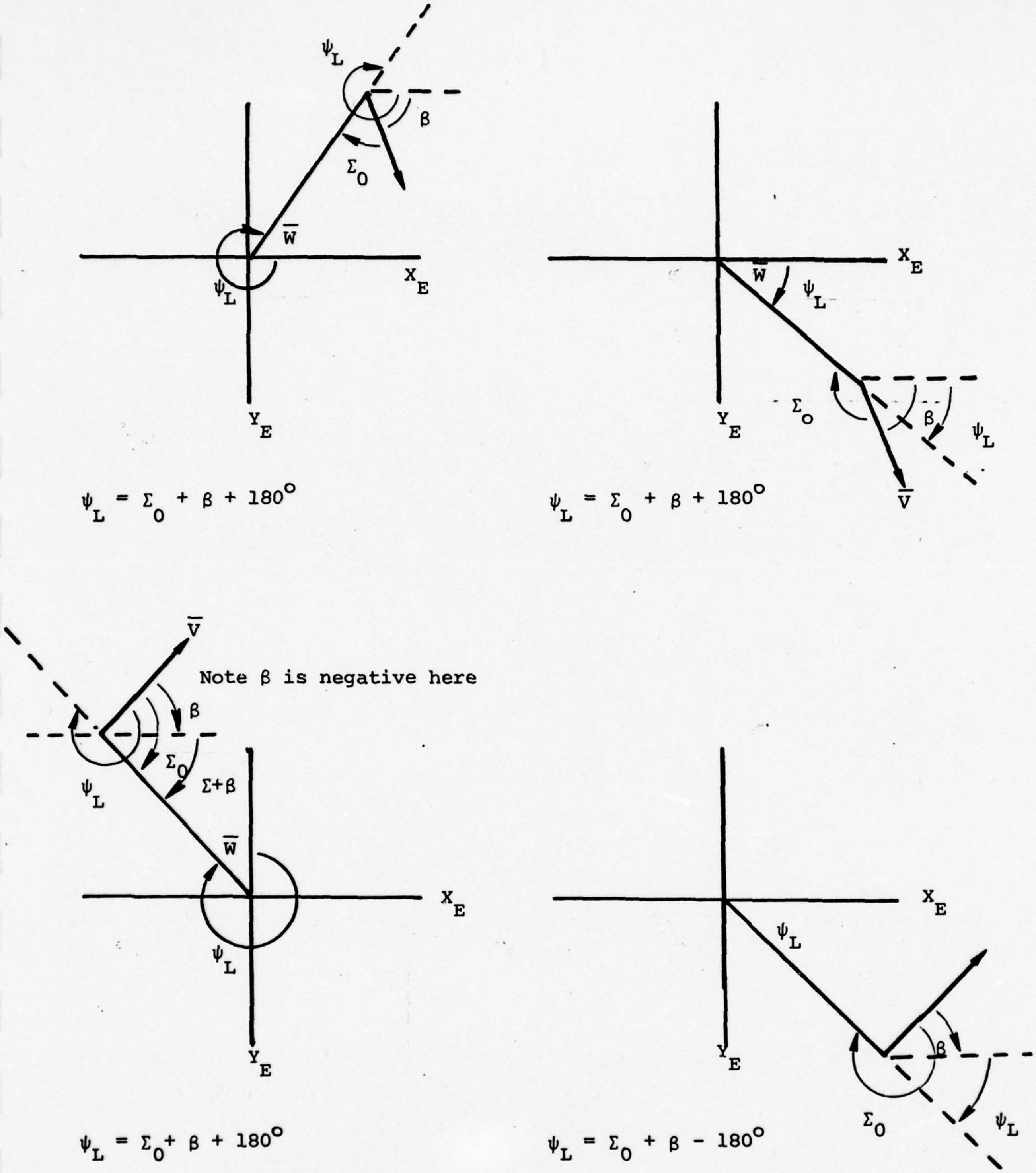
CASE 4c

$\dot{X}_{TE}(0)$	$\dot{Y}_{TE}(0)$ and $Z_{TE} < 0$
0	0
>0	0}Computer implementation does not
<0	0}take care of these two cases

$\psi_L(0) = 0$

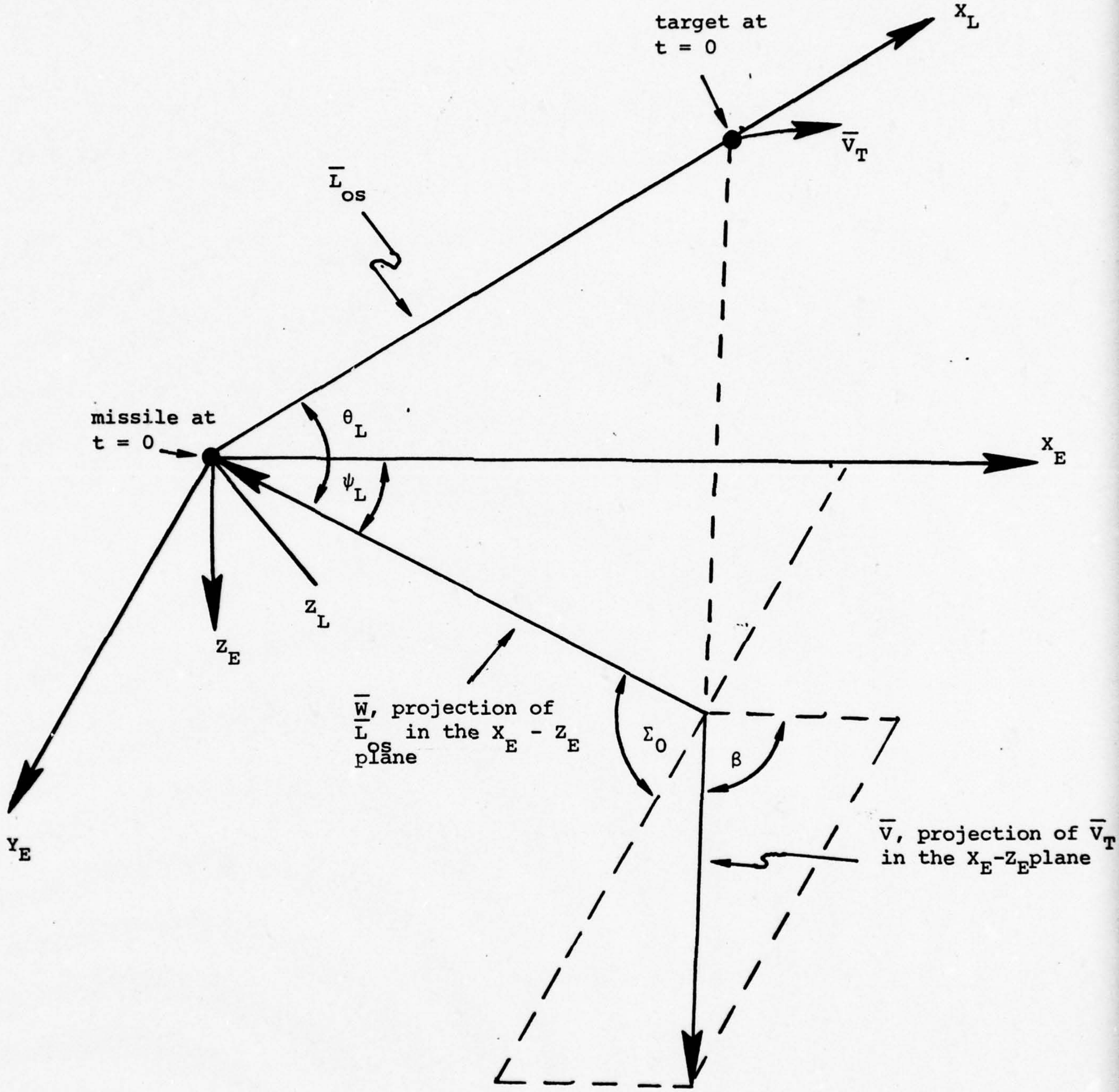
$SEO = -90^{\circ}$

For vertical target trajectory crossing angle is not applicable, program sets KKK = 1



SOME POSSIBLE CONFIGURATIONS OF $\overline{V}$ AND $\overline{W}$

FIGURE 2.2



RELATIONSHIP OF $\overline{V}$ AND $\overline{W}$ TO $\overline{V}_T$ AND $\overline{L}_{os}$

FIGURE 2.3

TRANSFORMATION OF TARGET VELOCITY COMPONENTS FROM EARTH FIXED TO LAUNCH COORDINATES

$$\begin{bmatrix} X_{TL}(0) \\ Y_{TL}(0) \\ Z_{TL}(0) \end{bmatrix} \begin{bmatrix} \cos\theta_L \cos\psi_L & \cos\theta_L \sin\psi_L & -\sin\theta_L \\ -\sin\psi_L & \cos\psi_L & 0 \\ \sin\theta_L \cos\psi_L & \sin\theta_L \sin\psi_L & \cos\theta_L \end{bmatrix} \begin{bmatrix} X_{TE}(0) \\ Y_{TE}(0) \\ Z_{TE}(0) \end{bmatrix}$$

where $\theta_L = \theta_L(0)$

$\psi_L = \psi_L(0)$

This transformation is performed in Subroutine GUID

RANGE TABLE GENERATION

The range-table is generated for use as a data collection tool during real time simulation. The range table is a set of relative missile minus target positions along the X_L axis at which data collection should be performed. Generation of the range table follows from specification of

XTERM, the last data point to be collected

DX, the distance between data points

NPTS, number of data points desired

Provided analog scaling permits the collection of NPTS points, this is done. Otherwise, the program automatically reduces the value of NPTS until analog scaling requirements are satisfied. The new value of NPTS is stored for later usage as NADJ.

The rule for reducing NPTS to a final value of NADJ is given below

$$\text{NADJ} = \begin{cases} \text{NPTS}, & \text{if DIF} > 0 \\ \text{NPTS} - \text{truncated value of (DIF/DX)} - 1, & \text{if DIF} \leq 0 \end{cases}$$

Here DIF is defined as the difference between the data collection distance commanded and the largest data collection distance possible with the analog scaling given. DIF can be computed as follows

$$\text{DIF} = \{\text{XTERM} + (\text{NPTS}-1)\text{DX}\} - \left\{\frac{(\text{Analog Scale Factor})\ (\text{Largest Voltage})}{1 + \gamma}\right\}$$

TABLE 2.1 DESCRIPTION OF MAIN PROGRAM SYMBOLS (Pre-Real-Time)

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
IS1*	--------	Print flag, IS1 $\neq$ 1 indicates print is desired.
NSAM*	--------	Quality control test case sample size 2 $\leq$ NSAM $\leq$ 11
ICON*	--------	Automatic or manual launch set selection (ICON = 1 implies automatic, ICON = 2 implies manual)
INL*	--------	Number of first launch set desired in automatic mode, 1 $\leq$ INL $\leq$ 60
CLMS(I)*	--------	Used in computation of quality control limits. For further information see SUBROUTINE QCLIM
CLS1(I)*	--------	
CLS2(I)*	--------	
Q1, Q2, ...Q6*	--------	
W1, W2, ...W6*	--------	
NRUNS*	--------	Number of runs (NRUNS $\leq$ 20)
NPTS*	--------	Number of data points to be collected in real time
DX*	--------	Distance between real-time data collection points (FT)
XTERM*	--------	Distance between target and missile at last data collection point (FT)
NL*	--------	NL + 1 is number of launch sets to be read from data cards, if NL $\geq$ 61
ZTEO(I)*	--------	Launch set target altitude in earth fixed coordinates (FT) (Note: printout shows - ZTEO(I))
ASC(I)*	Σ_0	Launch set target crossing angle table, measured positive clockwise from $\overline{V}$ to $\overline{W}$ (DEG)

*Data input from card reader

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
RR(I)*	R_i	Launch set target initial range table (FT) (distance measured along the line of sight)
III*	--------	Flag for automatic selection of target trajectory III = 1, for manual selection set III ≠ 1.
IRSS*	--------	Flag, IRSS simulation requires IRSS = 1, for MICOM Hybrid set IRSS ≠ 1.
KA*	--------	Index of target launch set. This is used in manual mode, i.e., III = 1
ITT*	--------	Trajectory number, ITT = 1 selects a stationary target. In general $1 \leq ITT \leq 45$
NOGO*	--------	
TAU*	τ	A parameter which selects a portion of the target velocity-time manuever table for use in the simulation. This parameter shifts time forward TAU seconds and disregards all manuever information between time = 0 and time = TAU. Note: $0 \leq TAU \leq 27$. With TAU = 0 the manuever tables are unchanged. (SEC)
ZABOVE	Δh	Altitude of missile above sea level at t = 0
RTD	--------	Conversion factor for radians to degrees
DTR	--------	Conversion factor for degrees to radians
RLBK	L/B	L/B, actual plume ratio of length to breadth
NT	--------	Length of the trajectory time and velocity tables (currently NT = 27)
TMAS(K)	--------	Adjusted target time, see definition of τ

* Data input from card reader

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
I99	--------	Flag, if the current launch set number is a multiple of five or if this is the first launch set then I99 = 1. Otherwise I99 = 0
I88	--------	Flag, if this is last launch set in automatic selection sequence I88 = 1, otherwise I88 = 0
XE(I)	$\ddot{X}_{TE}$	Target acceleration tables, derived from target velocity tables.
YE(I)	$\ddot{Y}_{TE}$	
ZE(I)	$\ddot{Z}_{TE}$	
Z	$Z_{TE}(0)$, h	Specific launch altitude (from launch set table ZTEO
ZZZ, ZALT	h_{asL}	Specific target altitude in earth fixed coordinates + altitude of missile launch site above sea level (FT)
AS	Σ_0	Specific launch crossing angle (from launch set table ASC(I)
R	R_i	Specific launch initial range (from launch set table RR(I)
XD	$\dot{X}_{TE}(o)$	Initial target velocities in earth fixed coordinate system
YD	$\dot{Y}_{TE}(0)$	
ZD	$\dot{Z}_{TE}(0)$	
ASCO	ψ_L	Angle from positive X_E - axis to the vector from origin to target (note this is just $-\overline{W}$)
SCO	ψ_L	ψ_L in DEG
SO	θ_L	Initial elevation angle of target (RAD)
ASO	θ_L	θ_L in DEG

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
X	$X_{TE}(0)$	X and Y components of $\overline{L}_{os}$ in earth fixed coordinate system
Y	$Y_{TE}(0)$	
SINSO	$\sin(\theta_L)$	
COSSO	$\cos(\theta_L)$	
SINSCO	$\sin(\psi_L)$	
COSSCO	$\cos(\psi_L)$	
S2	$\cos(\theta_L)\cos(\psi_L)$	
S3	$\sin(\theta_L)\cos(\psi_L)$	
S4	$\cos(\theta_L)\sin(\psi_L)$	
S5	$\sin(\theta_L)\sin(\psi_L)$	
SPL	$\sin(\psi_L)$	
CTL	$\cos(\theta_L)$	
CPL	$\cos(\psi_L)$	
STL	--------	$\sin(\theta_L)$
KKK	--------	KKK = 0, if $\dot{Y}_{TE}(0) \neq 0$ 1, if $\dot{Y}_{TE}(0) = 0$
VVVV	$V_T(0)$	Initial velocity of target
XDTGO	$\dot{X}_{TL}(0)$	Components of target velocity in launch coordinates
YDTGO	$\dot{Y}_{TL}(0)$	
ZDTGO	$\dot{Z}_{TL}(0)$	
SEO	--------	Dive angle (Note: some cases are computed in SUBROUTINE INIT)

III. PROGRAM MAIN (POST-REAL-TIME)

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III. PROGRAM MAIN (Post-Real-Time)

The post-real-time portion of the STINGER code provides an estimate of miss distance, lethality and simulation quality. In addition, the post-real-time code contains portions of the repeat run (rep-op) logic.

In general, the analysis in post-real-time data will contain the following events:

- If nonstationary target, calculate Euler angles for transformation from launch-to-target fixed coordinates
- Calculate the least square missile approach trajectory from collected A/D data and project miss distance information
- If the target is a high speed jet, perform a lethality test with the probability-of-kill model
- Repeat the simulated flight 20 times and obtain average PK, mean, and standard deviation of miss distance information
- Give control to pre-real time part for next simulation

More information concerning post-real-time data processing is contained in the Section titled SUBROUTINE MISCOM.

<u>TIME CRITICAL DATA COLLECTION TEST</u>

This test is performed to verify that each value of $X_{ML}-X_{TL}$ collected in real-time corresponds to a value in the range-to-go tables. The test is performed by testing each point collected as

$$XX_i \leq (X_{ML}-X_{TL})_i \leq XX_i + DX, \; i = 1, NADJ$$

where XX_i is the i'th entry in the pre-computed range-to-go table and $(X_{ML}-X_{TL})_i$ is the actual data point collected.

If time critical data collection failure is detected a diagnostic message is printed.

TABLE 3.1 DESCRIPTION OF MAIN PROGRAM SYMBOLS (Post-Real-Time)

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
NADJ	--------	The actual number of data collection points in real-time
XMISS(7)	--------	
PPX(I)	$X_{ML}-X_{TL}$	
PPY(I)	$Y_{ML}-Y_{TL}$	
PPZ(I)	$Z_{ML}-Z_{TL}$	
TIME(I)	t	Real time data collection points
VMX(I)	$\dot{X}_{ML}-\dot{X}_{TL}$	
VMY(I)	$\dot{Y}_{ML}-\dot{Y}_{TL}$	
VMZ(I)	$\dot{Z}_{ML}-\dot{Z}_{TL}$	
XX(I)	--------	Range-data collection table generated by SUBROUTINE INIT
LEVEL	--------	Status of maneuver, -7 implies not in real-time, 0 implies in real-time, +7 implies target trajectory table exceeded
ITT	--------	Target trajectory number, note: ITT = 1 is a stationary target
VVVV	$V_T(0)$	Initial target velocity
IS1	--------	Print flag, IS1 $\neq$ 1 indicates print is desired
XMAN(1,I)	t	Target maneuver velocity and time tables at range table data collection point (See MAN(J,I) in SUBROUTINE REALT)
XMAN(2,I)	$\dot{X}_{TL}$	
XMAN(3,I)	$\dot{Y}_{TL}$	
XMAN(4,I)	$\dot{Z}_{TL}$	

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
XM(1),YM(1),ZM(1)	--------	Missile trajectory peircing point in Y'_F - Z'_F plane
XM(2),YM(2),ZM(2)	--------	Missile trajectory piercing point in X'_F - Y'_F plane
XM(3),YM(3),ZM(3)	--------	Missile trajectory piercing point in X'_F - Z'_F plane
RM(1)	--------	Nearest approach of missile trajectory to origin in the Y'_F - Z'_F plane
RM(2)	--------	Nearest approach of missile trajectory to origin in the X'_F - Y'_F plane
RM(3)	--------	Nearest approach of missile trajectory to origin in the X'_F - Z'_F plane
AXM(ICN)	--------	Storage arrays for ICN'th repeat run, where ICN varys from 1 to NRUNS. The computer variables correspond to XM(1), YM(1), ZM(1) and RM(1) respectively
AYM(ICN)	--------	
AZM(ICN)	--------	
ARM(ICN)	--------	
AXB(ICN)	--------	Storage arrays for ICN'th repeat run, where ICN varys from 1 to NRUNS. The computer variables correspond to XM(2), YM(2), ZM(2) and RM(2) respectively
AYB(ICN)	--------	
AZB(ICN)	--------	
ARB(ICN)	--------	
AXC(ICN)	--------	Storage arrays for ICN'th repeat run, where ICN varys from 1 to NRUNS. The computer variables correspond to XM(3), YM(3), ZM(3) and RM(3) respectively
AYC(ICN)	--------	
AZC(ICN)	--------	
ARC(ICN)	--------	

PROGRAM SYMBOL	VARIABLE	DESCRIPTION
YA	a_1	See equations in SUBROUTINE MISCOM
ZA	a_2	See equations in SUBROUTINE MISCOM

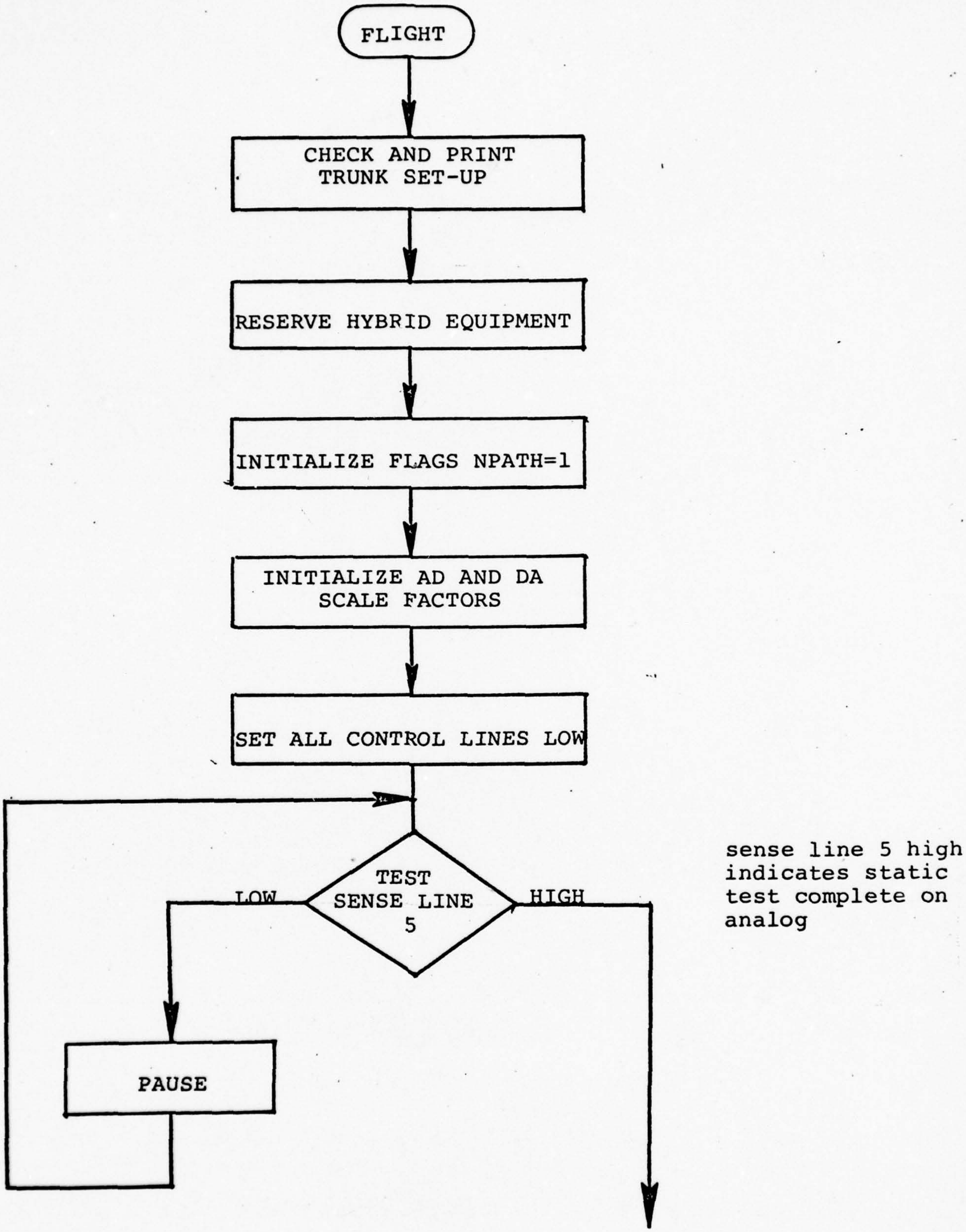
IV. SUBROUTINE FLIGHT AND REALT

IV. SUBROUTINE FLIGHT AND REALT (Real-Time)

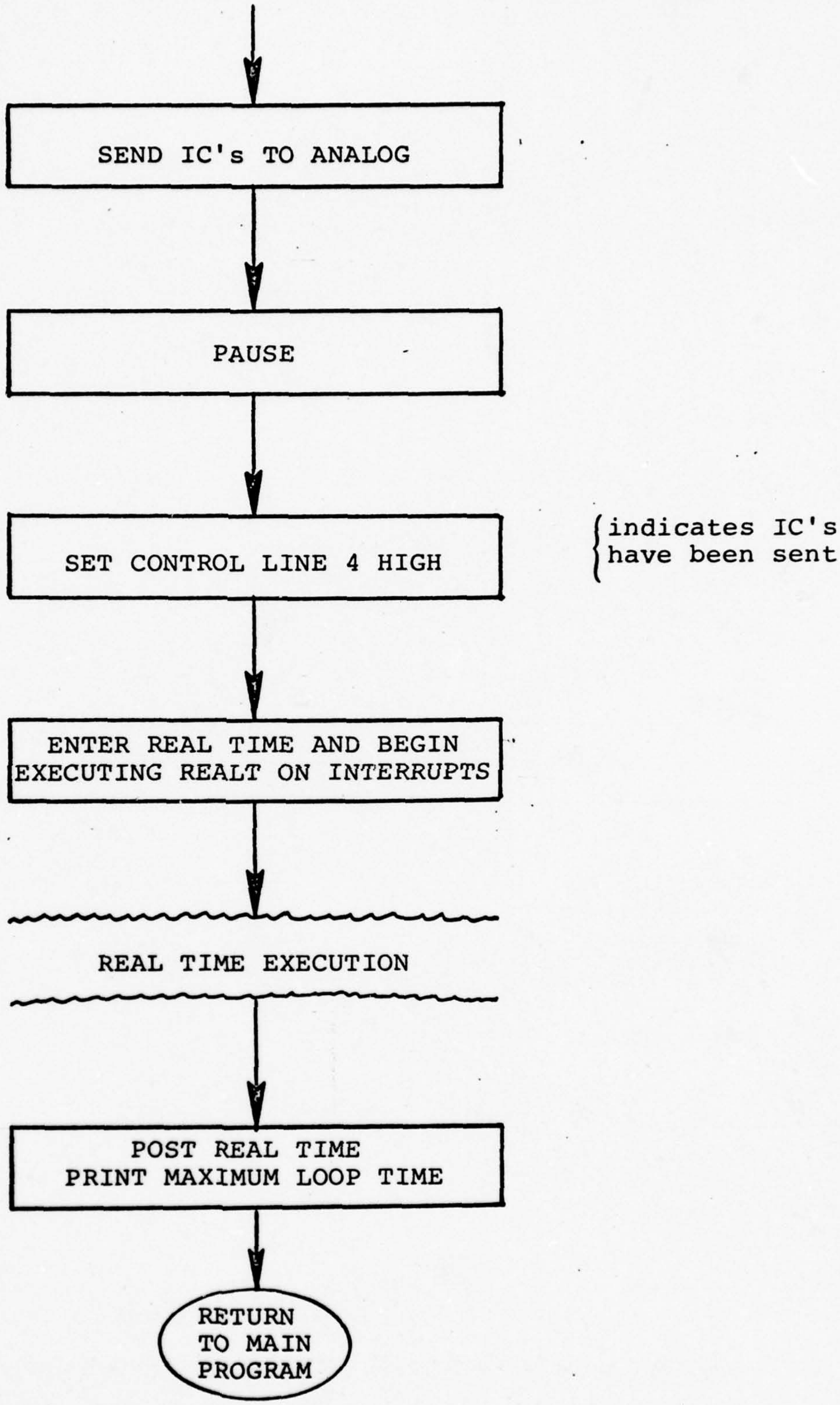
This section contains a description of Subroutines required during real-time operation of the MICOM Hybrid STINGER simulation. The documentation is provided in three parts:

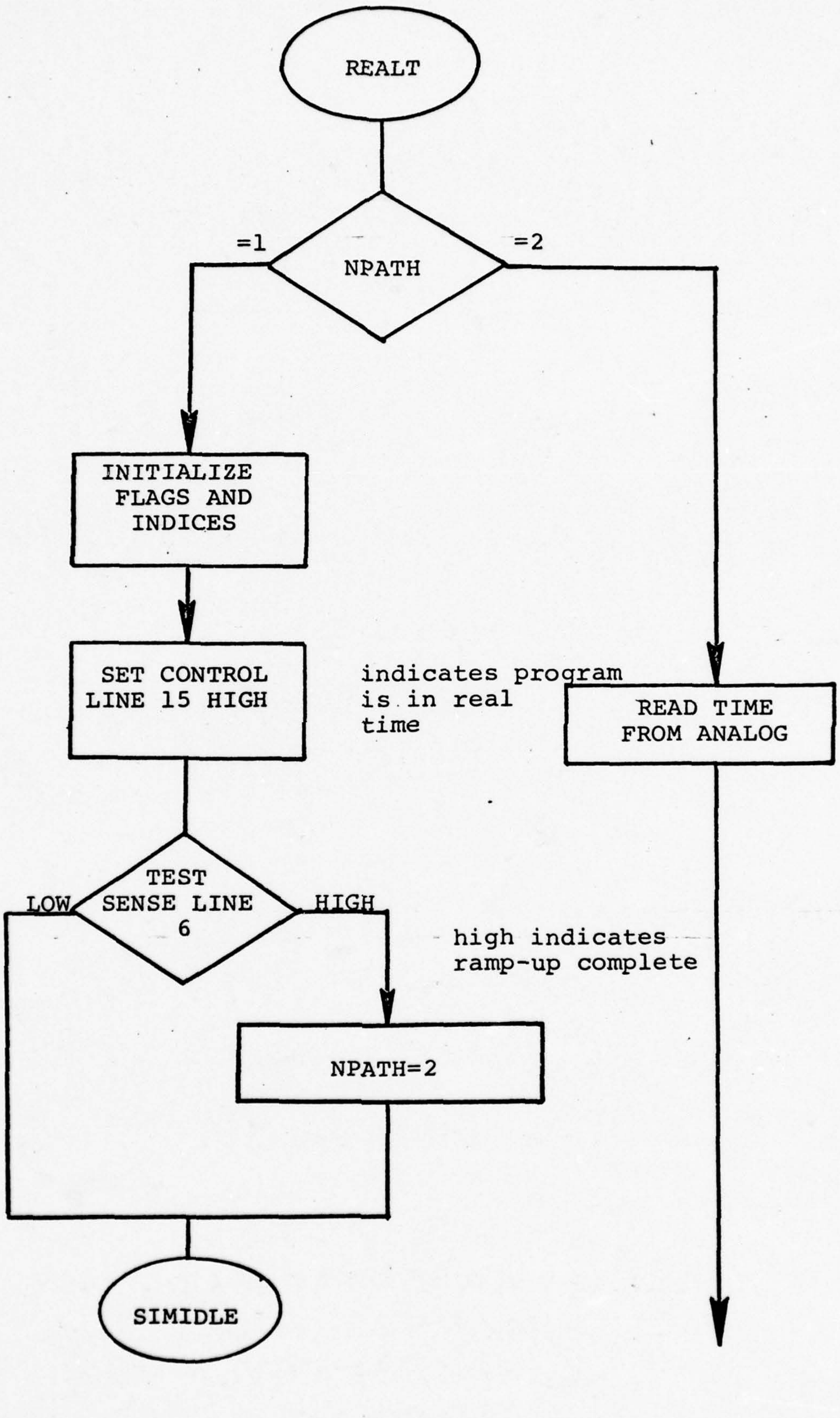
- Flow charts
- Equations
- Description of Symbols

The flow chart given in Figure 4.1 only to the digital program. However, the equations and description of symbols are given for both analog and digital implementations.

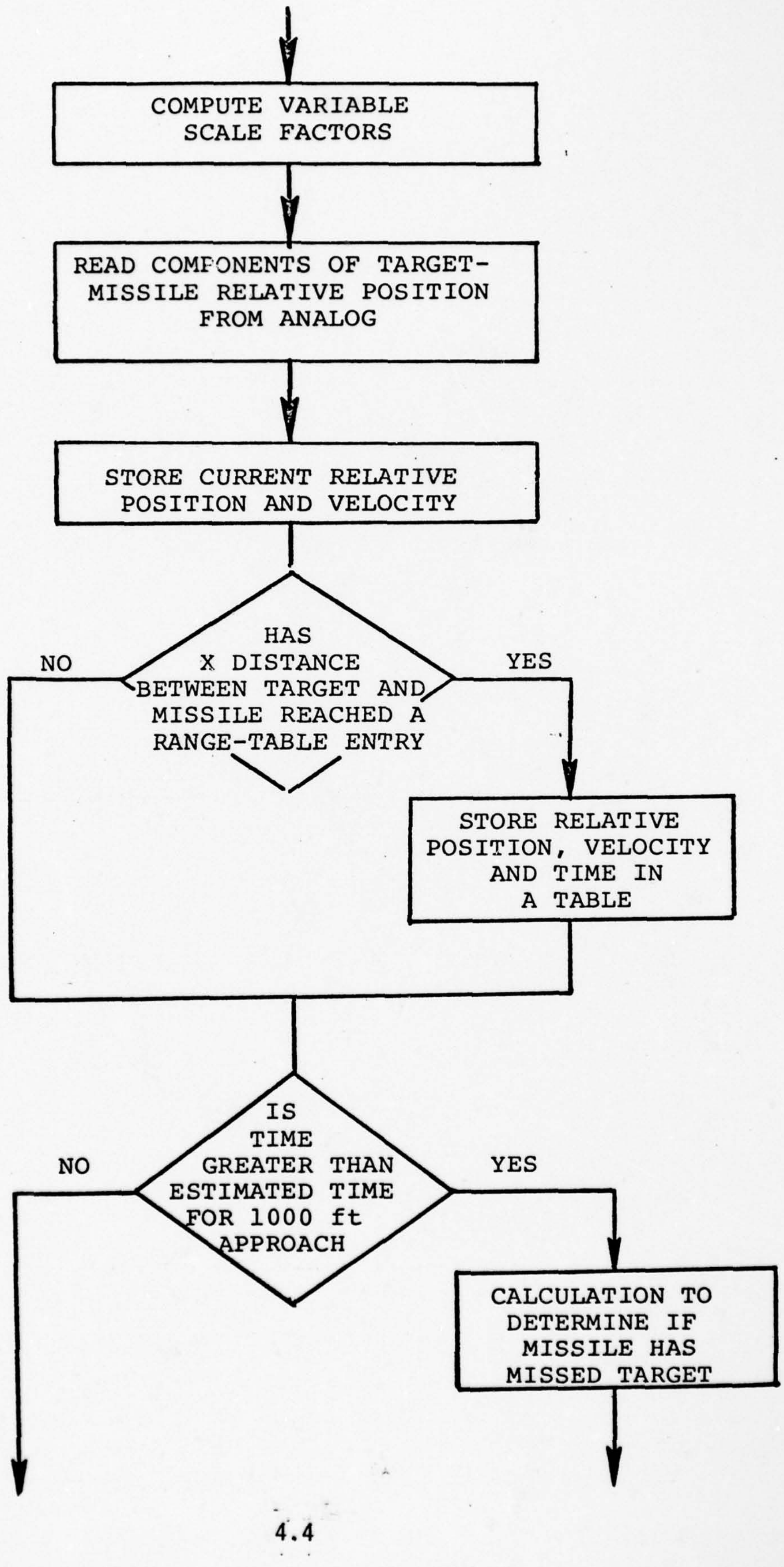


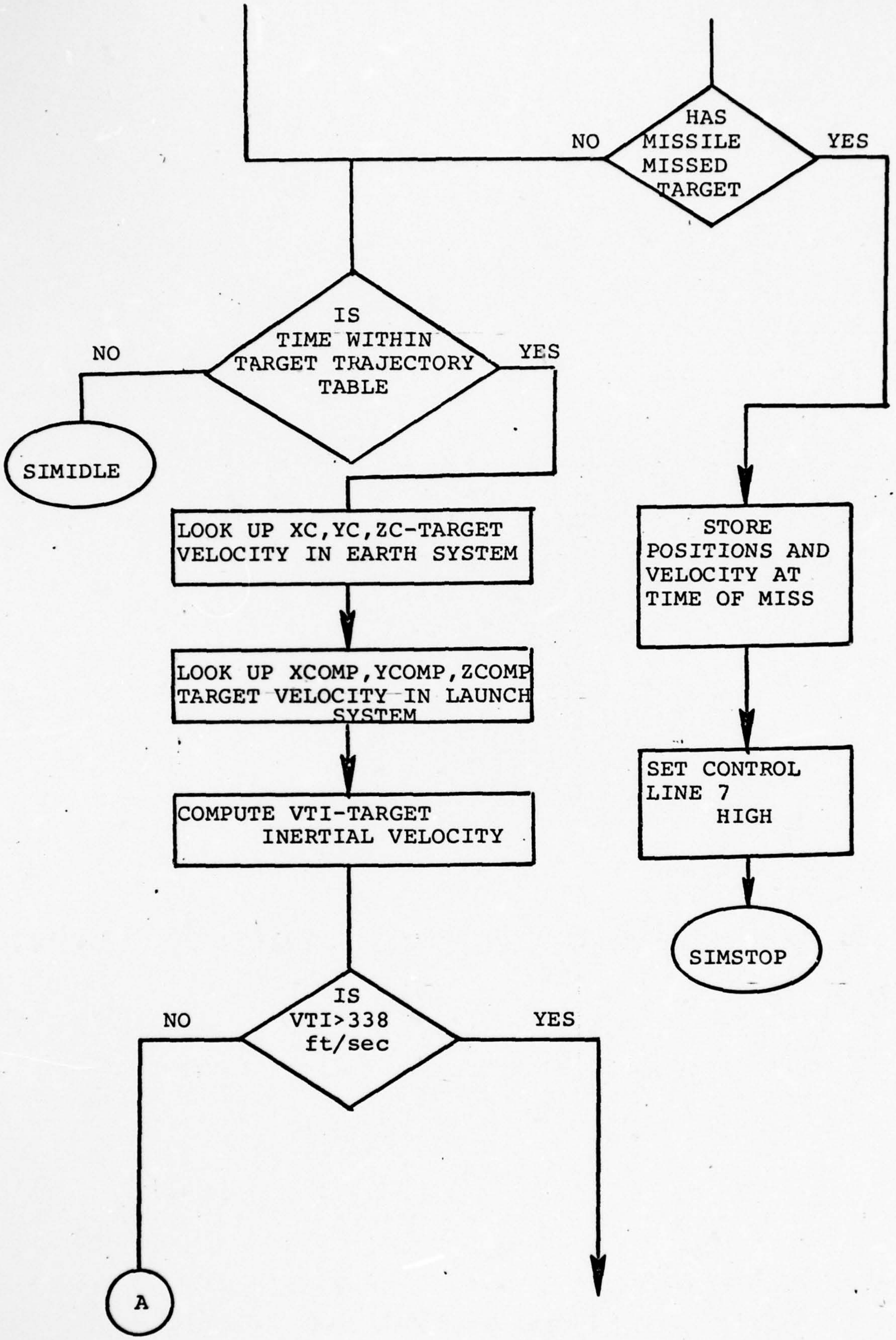
FLOW CHART FOR SUBROUTINE FLIGHT
FIGURE 4.1

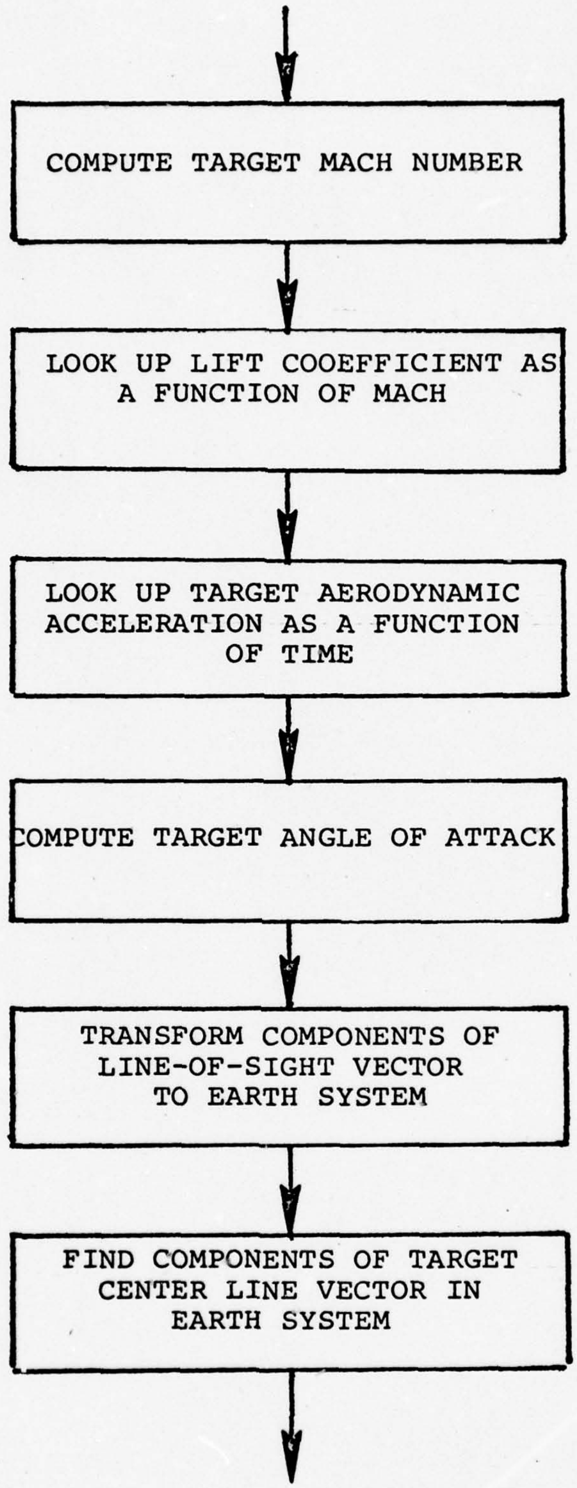

SEND IC's TO ANALOG
PAUSE
SET CONTROL LINE 4 HIGH
indicates IC's have been sent
ENTER REAL TIME AND BEGIN EXECUTING REALT ON INTERRUPTS
REAL TIME EXECUTION
POST REAL TIME
PRINT MAXIMUM LOOP TIME
RETURN TO MAIN PROGRAM

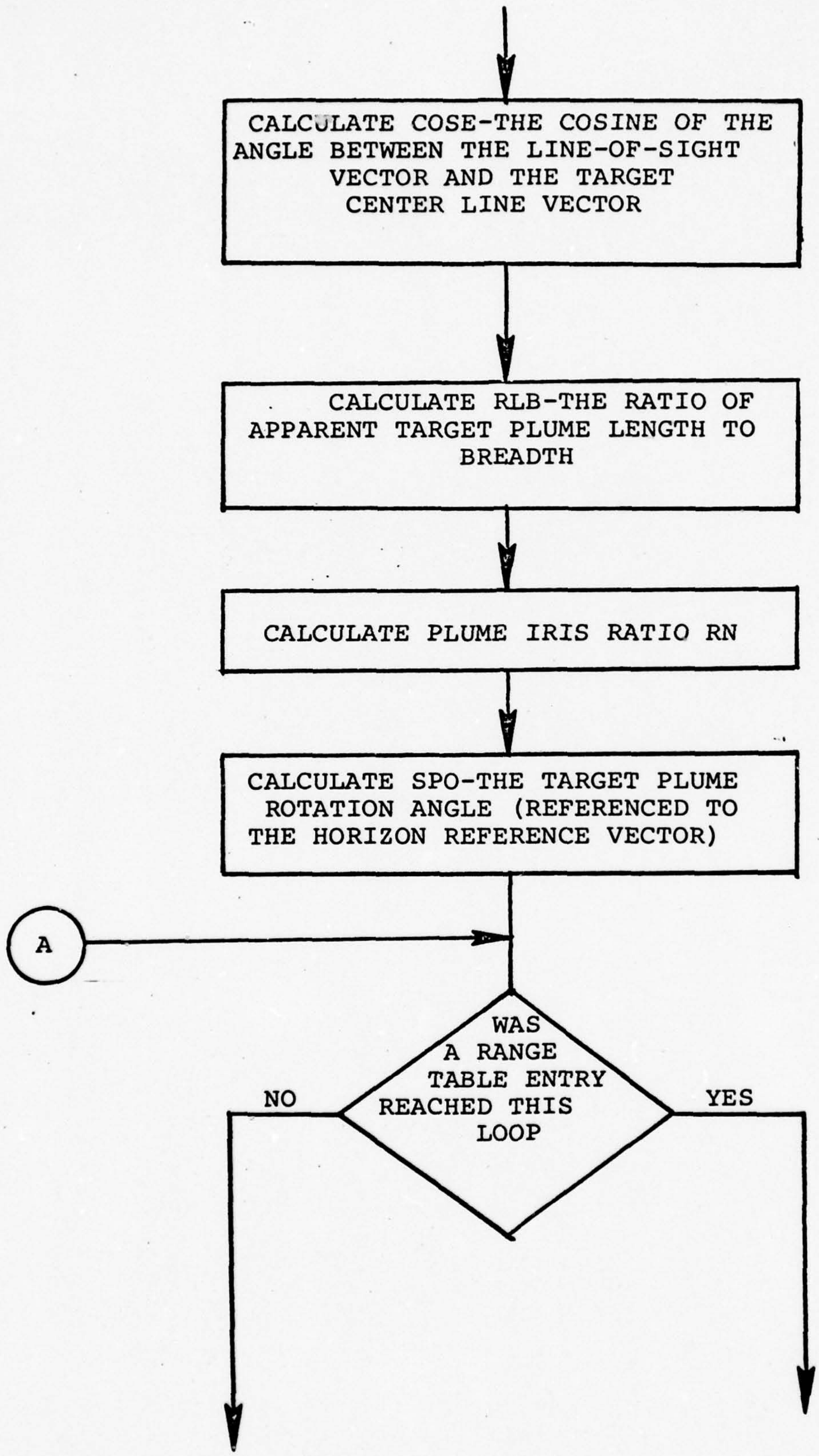


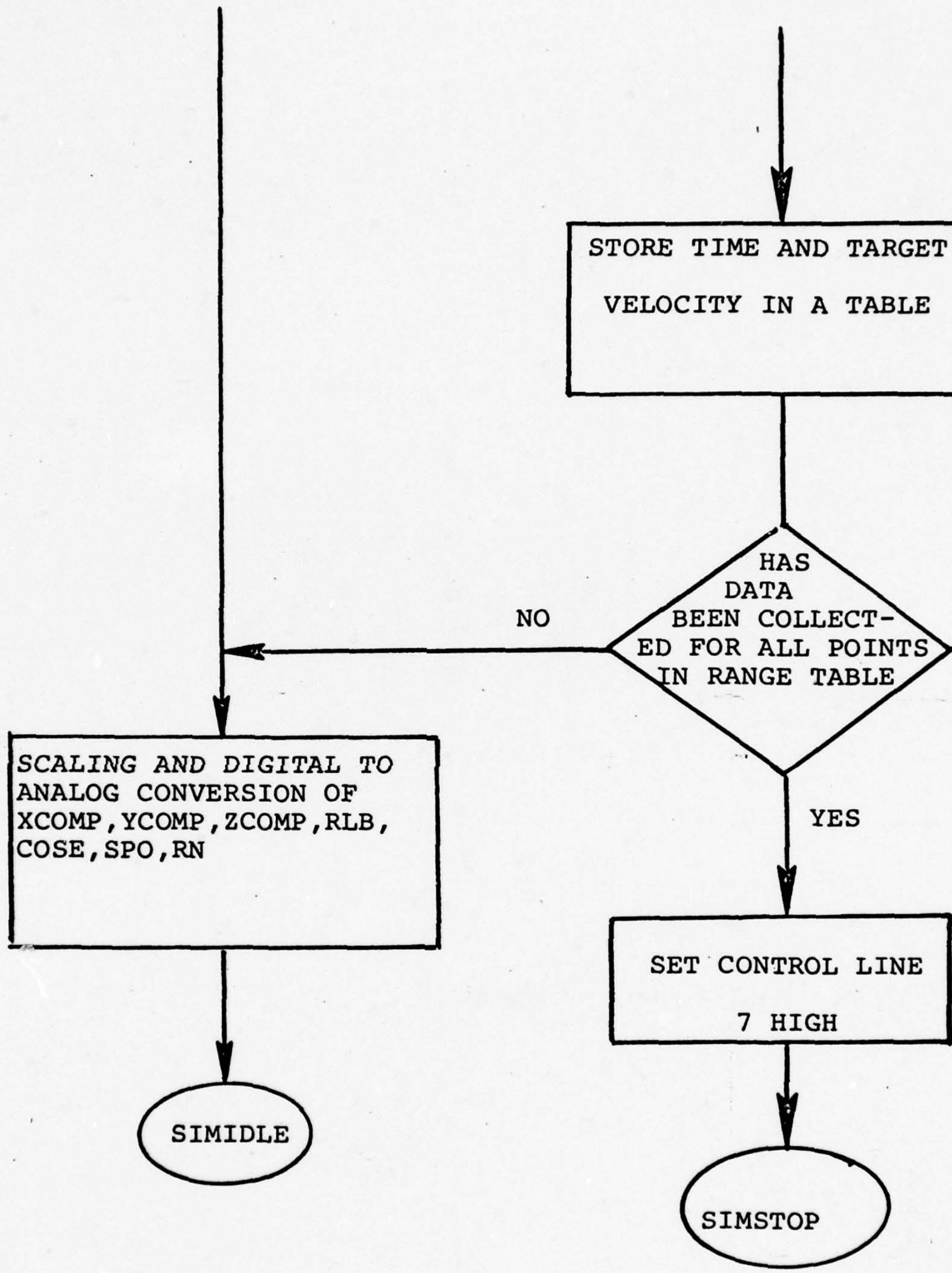
FLOW CHART FOR SUBROUTINE REALT
FIGURE 4.2


COMPUTE VARIABLE SCALE FACTORS
READ COMPONENTS OF TARGET-MISSILE RELATIVE POSITION FROM ANALOG
STORE CURRENT RELATIVE POSITION AND VELOCITY
HAS X DISTANCE BETWEEN TARGET AND MISSILE REACHED A RANGE-TABLE ENTRY
NO
YES
STORE RELATIVE POSITION, VELOCITY AND TIME IN A TABLE
IS TIME GREATER THAN ESTIMATED TIME FOR 1000 ft APPROACH
NO
YES
CALCULATION TO DETERMINE IF MISSILE HAS MISSED TARGET


HAS MISSILE MISSED TARGET
NO
YES
IS TIME WITHIN TARGET TRAJECTORY TABLE
NO
YES
SIMIDLE
LOOK UP XC,YC,ZC-TARGET VELOCITY IN EARTH SYSTEM
LOOK UP XCOMP,YCOMP,ZCOMP TARGET VELOCITY IN LAUNCH SYSTEM
COMPUTE VTI-TARGET INERTIAL VELOCITY
IS VTI>338 ft/sec
NO
YES
A
STORE POSITIONS AND VELOCITY AT TIME OF MISS
SET CONTROL LINE 7 HIGH
SIMSTOP


COMPUTE TARGET MACH NUMBER
LOOK UP LIFT COOEFFICIENT AS A FUNCTION OF MACH
LOOK UP TARGET AERODYNAMIC ACCELERATION AS A FUNCTION OF TIME
COMPUTE TARGET ANGLE OF ATTACK
TRANSFORM COMPONENTS OF LINE-OF-SIGHT VECTOR TO EARTH SYSTEM
FIND COMPONENTS OF TARGET CENTER LINE VECTOR IN EARTH SYSTEM


CALCULATE COSE-THE COSINE OF THE ANGLE BETWEEN THE LINE-OF-SIGHT VECTOR AND THE TARGET CENTER LINE VECTOR
CALCULATE RLB-THE RATIO OF APPARENT TARGET PLUME LENGTH TO BREADTH
CALCULATE PLUME IRIS RATIO RN
CALCULATE SPO-THE TARGET PLUME ROTATION ANGLE (REFERENCED TO THE HORIZON REFERENCE VECTOR)
A
WAS A RANGE TABLE ENTRY REACHED THIS LOOP
NO
YES


STORE TIME AND TARGET VELOCITY IN A TABLE
HAS DATA BEEN COLLECTED FOR ALL POINTS IN RANGE TABLE
NO
YES
SCALING AND DIGITAL TO ANALOG CONVERSION OF XCOMP,YCOMP,ZCOMP,RLB, COSE,SPO,RN
SET CONTROL LINE 7 HIGH
SIMIDLE
SIMSTOP

PLUME SHAPE

$$|\bar{L}_{os}| = \sqrt{(X_{ML}-X_{TL})^2 + (Y_{ML}-Y_{TL})^2 + (Z_{ML}-Z_{TL})^2}$$

$$P_1 = 2\tan^{-1}\left(\frac{B/2}{\ell}\right) \qquad \text{(DEG)}$$

$$P_2\text{INCH}^{\dagger} = \frac{(f)(\ell)}{|\bar{L}_{os}|} \qquad \text{(IN)}$$

$$P_2\text{RAD}^{\dagger} = \tan^{-1}(\ell/|\bar{L}_{os}| \qquad \text{(RAD)}$$

$$P_2\text{RAD}^{\dagger} \approx \ell/|\bar{L}_{os}| \qquad \text{(RAD)}$$

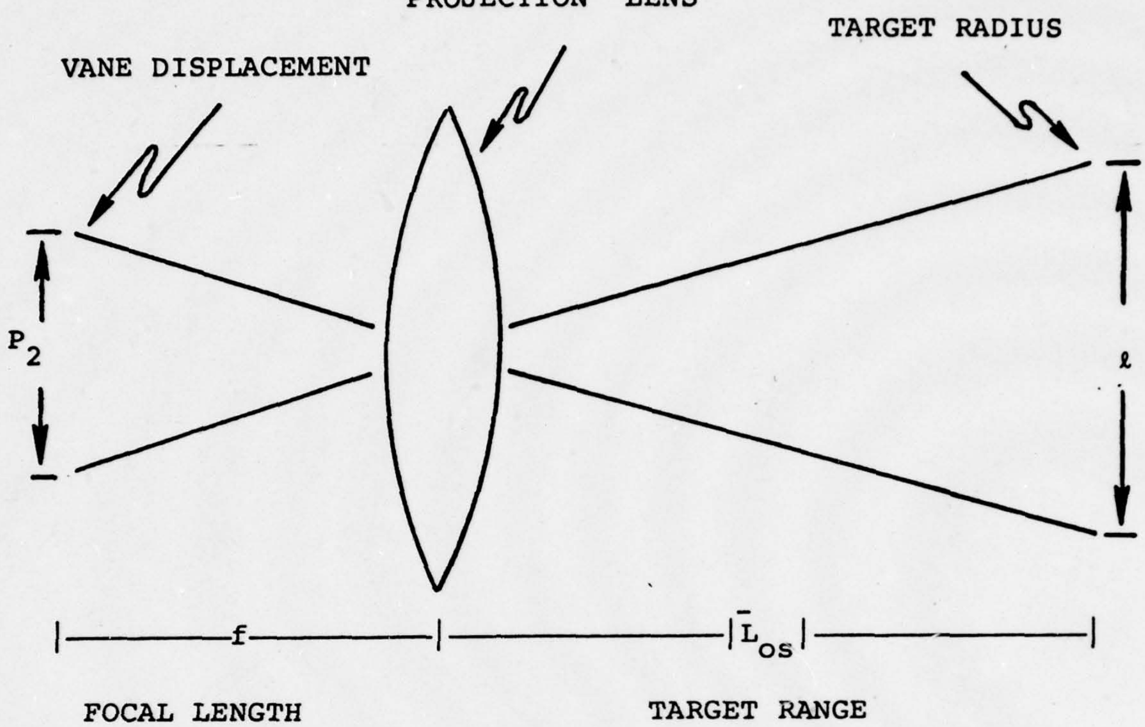


FIGURE 4.3

PLUME TRANSPARENCY

PLUME AZIMUTH AND ELEVATION

$\psi_7 = \psi_4 - P_2 \cos (T_{RP})$ (DEG)

$\dot{\psi}_7 = \psi_4$ (DEG/SEC)

$\theta_7 = \theta_4 - P_2 \sin (T_{RP})$ (DEG)

$\dot{\theta}_7 = \dot{\theta}_4$ (DEG/SEC)

PLUME LENGTH TO BREADTH RATIO AND ASPECT ANGLE

$\ell \approx L \sin(\varepsilon)$ if $B<L$, $B=3.0$

$$\ell = L \sqrt{1-\cos^2(\varepsilon)}$$

$$\ell/B = \frac{L}{B}\sqrt{1-\cos^2(\varepsilon)}$$

$$\cos(\varepsilon) = \frac{\bar{L}_{os} \cdot \bar{C}_L}{|\bar{L}_{os}||\bar{C}_L|}$$

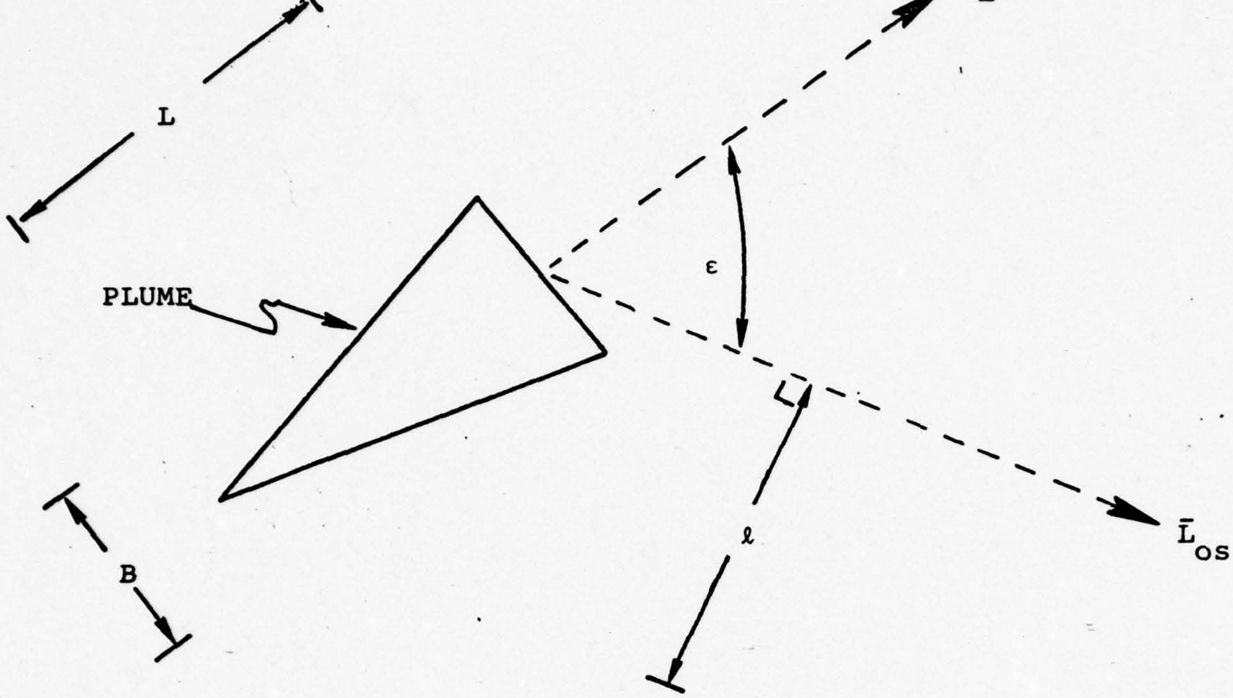


FIGURE 4.4

PLUME APPARENT LENGTH AND ASPECT ANGLE

PLUME IRIS RATIO

$$H_{c7} = \left(\frac{R}{7000}\right)^{-2.341} \left(H\Big|_{\varepsilon}^{R=7000}\right) \qquad (W/CM^2)$$

$$A_{t7} = \frac{P_{2INCH}^2 \, SIN(P_1)}{2 \, COS^2 \, (P_1/2)} \qquad (IN^2)$$

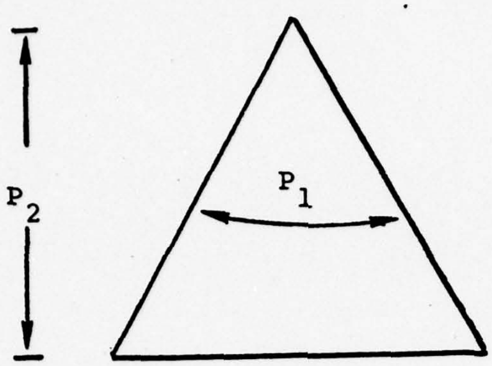
$$J_{tu7} = K_2 A_{t7}^{K_3}, \quad K_2 = .1, \; K_3 = 1.003258 \qquad (W/STER)$$

From IRSS Calibration curve fit

$$I_{r7} = \frac{\dfrac{H_{c7} f^2}{T_{f,plume}}}{J_{tu}}$$

$$i_7 = i_7 \, (I_{r7})$$

From IRSS Calibration limits



$$\boxed{AREA = P_2^2 \tan (P_1/2)}$$

OR

$$\boxed{AREA = \frac{P_2^2 \sin P_1}{2 \cos^2 (P_1/2)}}$$

FIGURE 4.5

AREA OF PLUME TRANSPARENCY

PLUME ROTATION ANGLE

$$\beta = \cos^{-1}\left(\frac{L_x}{\sqrt{L_x^2 + L_y^2}}\right)$$

$$C_x = -\cos \beta$$

$$C_y = \begin{cases} +\sin \beta \text{ if } L_x > 0 \\ -\sin \beta \text{ if } L_x < 0 \end{cases}$$

$$D_X = L_Y \cdot C_{LZ} - L_Z \cdot C_{LY}$$

$$D_Y = L_Z \cdot C_{LY} - L_X \cdot C_{LZ}$$

$$D_Z = L_X \cdot C_{LY} - L_Y \cdot C_{LX}$$

$$\cos \theta = \frac{(\bar{L}_{os} \times \bar{C}_L) \cdot \bar{C}}{|\bar{L}_{os} \times \bar{C}_L| \cdot |\bar{C}|} \text{ , or } \theta = \cos^{-1}\left(\frac{(D_X \cdot C_X + D_Y \cdot C_Y)}{\sqrt{D_X^2 + D_Y^2 + D_Z^2}}\right)$$

$$T_{RP} = \begin{cases} \pi/2 - \theta & \text{if } D_Z < 0 \\ \pi/2 + \theta & \text{if } D_Z > 0 \text{ and } \theta < \pi/2 \\ \theta - 3\pi/2 & \text{if } D_Z > 0 \text{ and } \theta > \pi/2 \end{cases}$$

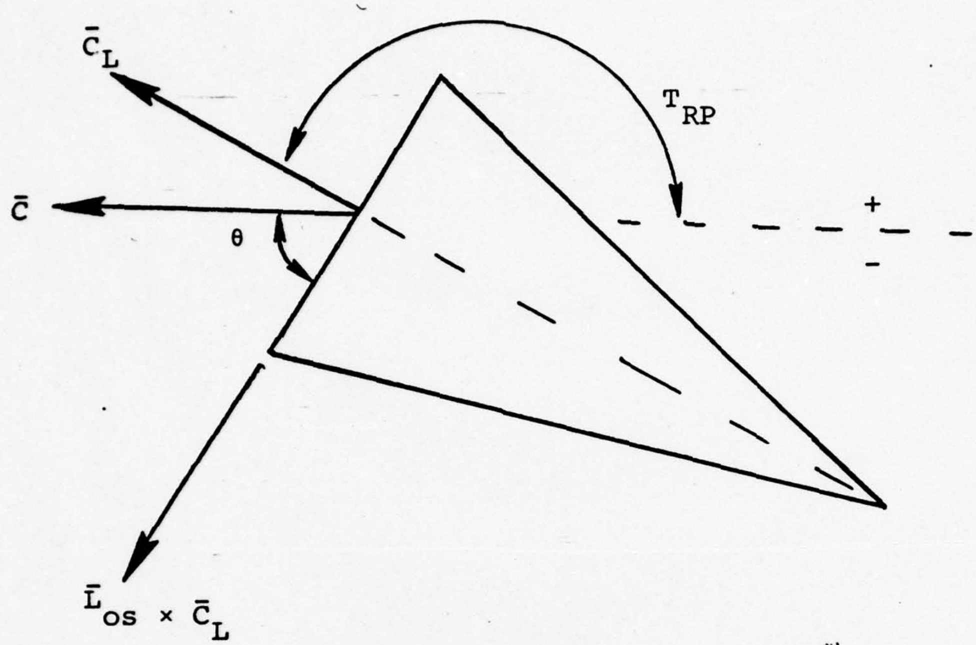


FIGURE 4.6

APPARENT TARGET PLUME AS SEEN FROM THE MISSILE SEEKER
(THE PLANE OF THE PAPER IS PERPENDICULAR TO THE $\bar{L}_{OS}$ VECTOR)

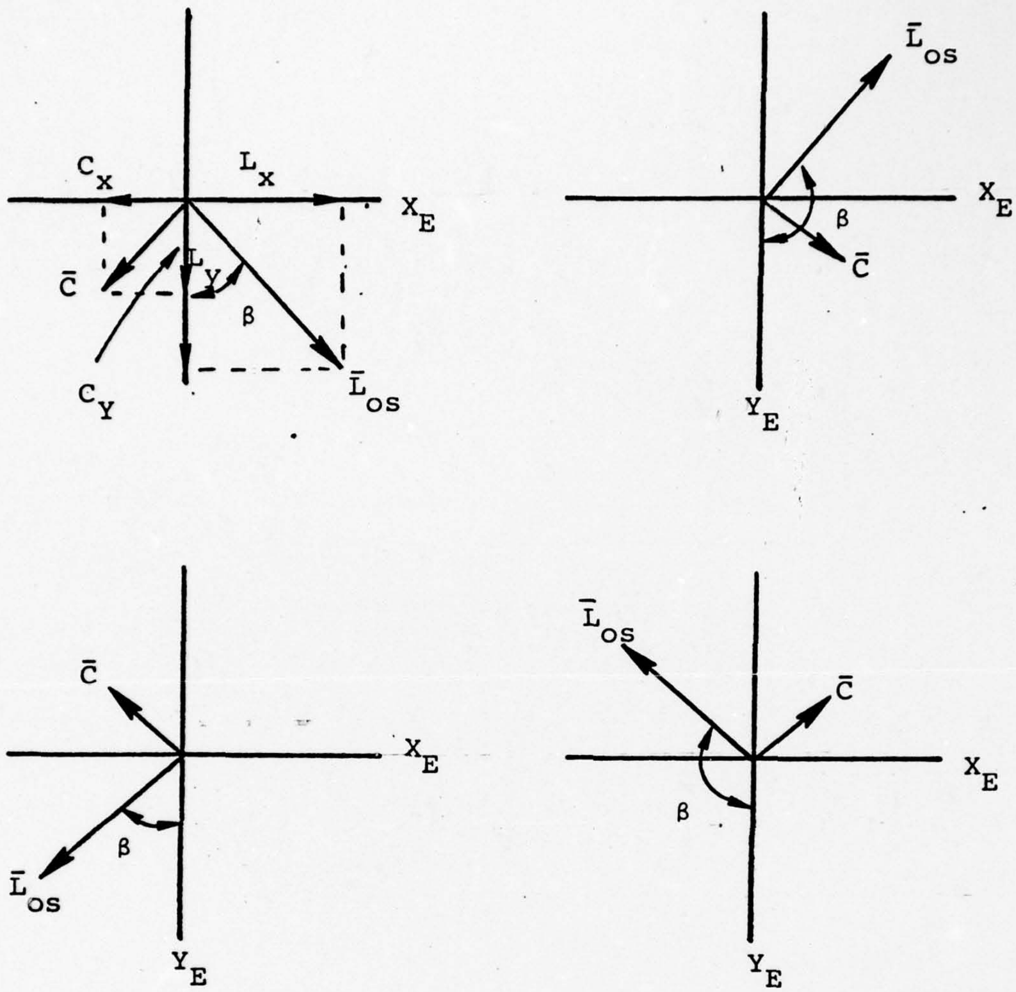


FIGURE 4.7

EXHAUSTION OF GENERAL CONFIGURATIONS FOR $\bar{L}_{OS}$ AND $\bar{C}$

TARGET ANGLE OF ATTACK AND MACH NUMBER

$$\rho = .00237692\ e^{-.00003h_{aSL}} \qquad (SLUGS/FT^3)$$

$$V_T = \sqrt{\dot{X}_{TE}^2 + \dot{Y}_{TE}^2 + \dot{Z}_{TE}^2} \qquad (FT/SEC)$$

$$C_{L_{\alpha_T}} = CLAA\Big|_{Q_M}$$

$$a_s = 1116.89 - .003894\ h_{aSL} \qquad (FT/SEC)$$

$$Q_M = V_T/a_S$$

$$h_{aSL} = \sqrt{X_{ML}^2 + Z_{ML}^2}\ \sin\left[\tan^{-1}\left(\frac{-Z_{ML}}{X_{ML}}\right) + \theta_L\right] + \Delta h^* \qquad (FT)$$

ΔL = Altitude of launch site above sea level (FT)

$$\alpha = \frac{2W_T}{\rho V_T^2\ C_{L_{\alpha_T}} S_T g}\left(\sqrt{X_{TE}^2 + Y_{TE}^2 + Z_{TE}^2}\right) \qquad (RAD)$$

*THIS MODEL IS NOT CURRENTLY INCORPORATED IN THE MICOM REAL TIME SIMULATIONS.

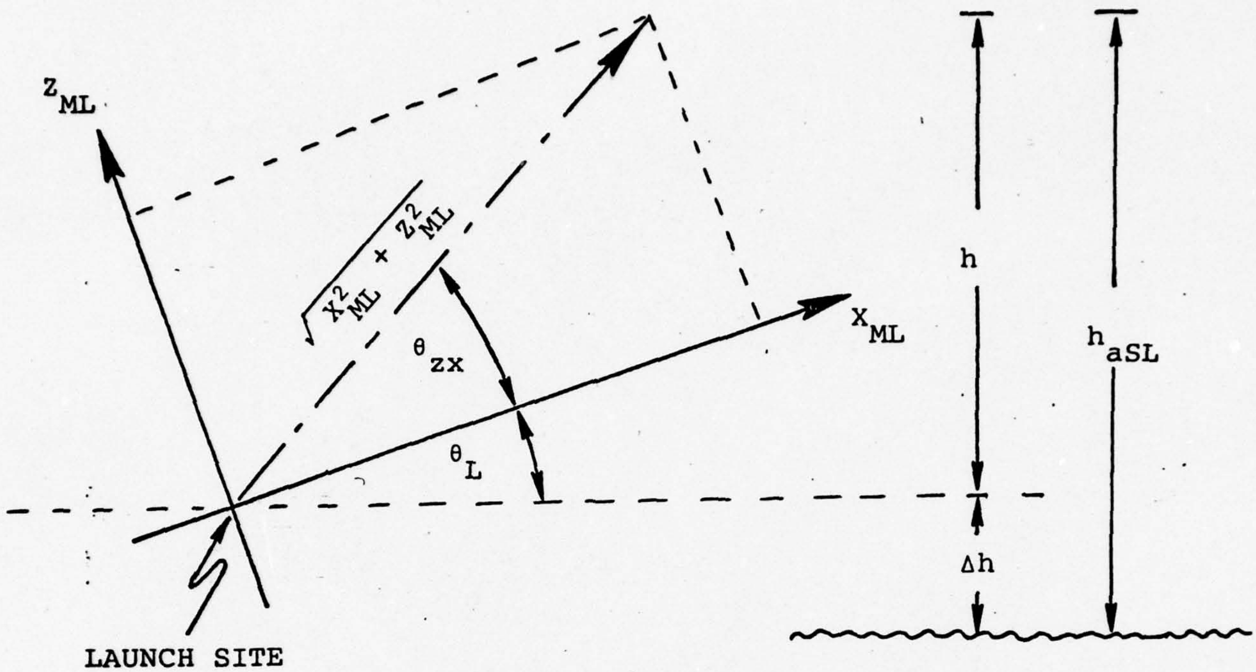


FIGURE 4.8

ALTITUDE OF TARGET ABOVE SEA LEVEL

FLARE TRANSPARENCY RADIUS AND IRIS RATIO

$J_{tu2} = J_{tu2}(t_{FD})$ (W/STER), DFG

$R_F = \sqrt{(X_{ML}-X_{2L})^2 + (Y_{ML}-Y_{2L})^2 + (Z_{ML}-Z_{2L})^2}$

$H_{c2} = J_{tu2} / R_F^2$ (W/CM^2), DFG

$t_2 = t_2 (H_{c2})$ (RAD), DFG

$i_2 = i_2 (H_{c2})$ (RAD), DFG based on IRSS calibration limits.

FLARE AZIMUTH AND ELEVATION

$$\sigma_{Y2} = \frac{Y_{ML}-Y_{2L}}{X_{ML}-X_{2L}} \quad \text{(RAD)}$$

$$\psi_{24REL} = \begin{cases} 57.3\ (\sigma_{Y4}-\sigma_{Y2}),\ t \geq t_{EJECT} \\ 0,\ t < t_{EJECT} \end{cases} \quad \text{(DEG.)}$$

$$\dot{\psi}_{24REL} = 57.3 \left\{ \left[\frac{(\dot{Y}_{ML}-\dot{Y}_{4L}) - \sigma_{Y4}\ (\dot{X}_{ML}-\dot{X}_{4L})}{X_{ML}-X_{4L}} \right] - \left[\frac{(\dot{Y}_{ML}-\dot{Y}_{2L}) - \sigma_{Y2}(\dot{X}_{ML}-\dot{X}_{2L})}{X_{ML}-X_{2L}} \right] \right\} \quad \text{(DEG/SEC)}$$

$$\psi_2 = \psi_4 - \psi_{24REL} \quad \text{(DEG)}$$

$$\dot{\psi}_2 = \dot{\psi}_4 - \dot{\psi}_{24REL} \quad \text{(DEG/SEC)}$$

$$\theta_{24REL} = \begin{cases} -57.3(\sigma_{Z4}-\sigma_{Z2}),\ t > t_{EJECT} \\ 0,\ t < t_{EJECT} \end{cases} \quad \text{(DEG)}$$

$$\dot{\theta}_{24REL} = -57.3 \left\{ \left[\frac{(\dot{Z}_{ML}-\dot{Z}_{4L}) - \sigma_{Z4}(\dot{X}_{ML}-\dot{X}_{4L})}{(X_{ML}-X_{4L})} \right] - \left[\frac{(\dot{Z}_{ML}-\dot{Z}_{2L}) - \sigma_{Z2}(\dot{X}_{ML}-\dot{X}_{2L})}{(X_{ML}-X_{2L})} \right] \right\} \quad \text{(DEG/SEC)}$$

FLARE DYNAMICS

$$X_{2L} = \frac{-\rho\ C_{D2}\ S_2 V_2\ X_{2L}}{2M_2} - g \sin \theta_L\ ,\ t>t_{EJECT}$$

$$Y_{2L} = \frac{-\rho\ C_{D2} S_2\ V_2\ X_{2L}}{2M_2}\ ,\ t>t_{EJECT}$$

$$Z_{2L} = \frac{-\rho\ C_{D2} S_2\ V_2\ Z_{2L}}{2M_2} + g \cos \theta_L\ ,\ t>t \qquad (FT/SEC^2)$$

$$\left.\begin{aligned} X_{2L} &= X_{4L} \\ Y_{2L} &= Y_{4L} \\ Z_{2L} &= Z_{4L} \\ \dot{X}_{2L} &= \dot{X}_{4L} \\ \dot{Y}_{2L} &= \dot{Y}_{4L} \\ \dot{Z}_{2L} &= \dot{Z}_{4L} \end{aligned}\right\}\ t<t_{EJECT} \qquad (FT)$$

TAILPIPE AZIMUTH AND ELEVATION

$$\sigma_{Y4} = \frac{Y_{ML}-Y_{4L}}{X_{ML}-X_{4L}} \qquad \text{(RAD)}$$

$$\psi_4 = 57.3\ \sigma_{Y4} \qquad \text{(DEG)}$$

$$\dot{\psi}_4 = 57.3 \left[\frac{(\dot{Y}_{ML}-\dot{Y}_{4L}) - \sigma_{Y4}(\dot{X}_{ML}-\dot{X}_{4L})}{(X_{ML}-X_{4L})} \right] \qquad \text{(DEG/SEC)}$$

$$\sigma_{Z4} = \frac{Z_{ML}-Z_{4L}}{X_{ML}-X_{4L}} \qquad \text{(RAD)}$$

$$\theta_4 = -57.3\ \sigma_{Z4} \qquad \text{(DEG)}$$

$$\dot{\theta}_4 = -57.3 \left[\frac{(\dot{Z}_{ML}-\dot{Z}_{4L}) - \sigma_{Z4}(\dot{X}_{ML}-\dot{X}_{4L})}{(X_{ML}-X_{4L})} \right] \qquad \text{(DEG/SEC)}$$

PITCH, YAW AND ROLL POSITIONS

$P = 57.29 \int q'dt$ (DEG)

$Y = 57.29 \int r'dt$ (DEG)

$R = R(p')$ (DEG)

TRANSFORMATION OF $\bar{C}_L$ AND $\bar{L}_{os}$ FROM LAUNCH TO EARTH COORDINATES

$$\bar{C}_L = \bar{i}_E \left\{ \frac{X_{TE}}{V_T} \cos(\alpha) + \frac{X_{TE}\ Z_{TE}\ \mathrm{SIN}(\alpha)}{V_T\ \sqrt{\dot{X}_{TE}^2 + \dot{Y}_{TE}^2}} \right\}$$

$$+ \bar{j}_E \left\{ \frac{Y_{TE}}{V_T} \cos(\alpha) + \frac{Y_{TE}\ Z_{TE}\ \sin(\alpha)}{V_T \sqrt{\dot{X}_{TE}^2 + \dot{Y}_{TE}^2}} \right\}$$

$$+ \bar{K}_E \left\{ \frac{Z_{TE} \cos(\alpha)}{V_T} - \frac{\sqrt{X_{TE}^2 + Y_{TE}^2}\ \sin(\alpha)}{V_T} \right\}$$

$$\bar{L}_{os} = \bar{i}_E\ (X_G \cos\theta_L \cos\psi_L - Y_G \sin\psi_L + Z_G \sin\theta_L \cos\psi_L)$$

$$+ \bar{j}_E\ (X_G \cos\theta_L \sin\psi_L + Y_G \cos\psi_L + Z_G \sin\theta_L \sin\psi_L)$$

$$+ \bar{K}_E\ (-X_G \sin\theta_L + Z_G \cos\theta_L)$$

$$X_G = X_{ML} - X_{TL}$$

$$Y_G = Y_{ML} - Y_{TL}$$

$$Z_G = Z_{ML} - Z_{TL}$$

VARIABLE SCALE FACTOR

$$K = \begin{cases} 1 + \dfrac{\gamma t}{t'}, & t<t' \\ 1 + \gamma & t>t' \end{cases}$$

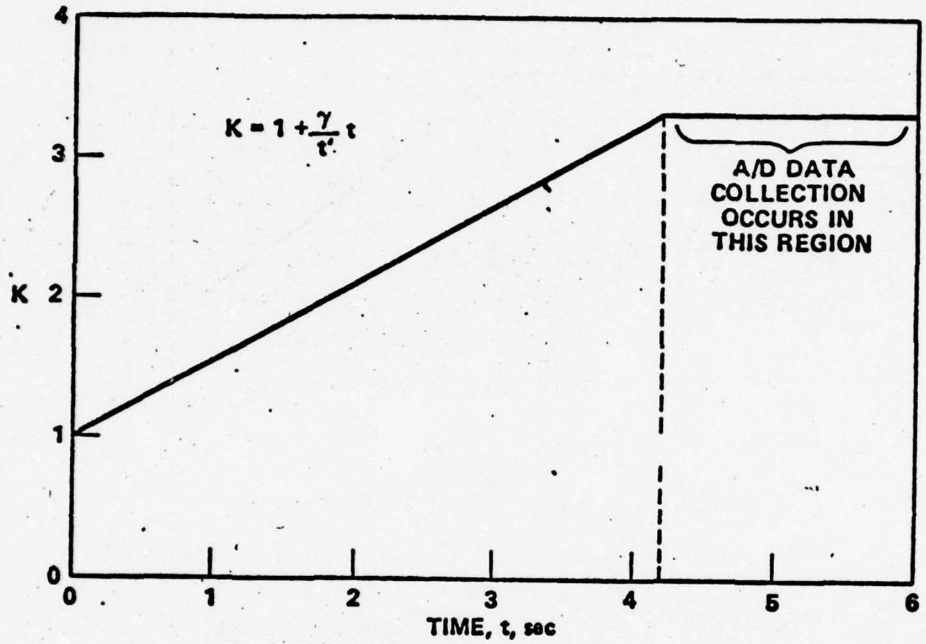


FIGURE 4.9
VARIABLE ANALOG SCALE FACTOR

TABLE 4.1

DESCRIPTION OF PROGRAM SYMBOLS
FOR SUBROUTINE FLIGHT AND REALT

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
________	SPO	Scaled plume rotation angle
T_{RP}	TRP	Plume rotation angle (RAD.)
θ_L	THETAL	Elevation angle of target (DEG.)
t	DT	Real time (SEC.)
g	________	Gravitational constant
x_E	XE	Target aerodynamic acceleration table in earth fixed coordinates (Note ZE includes an added factor of 32.174 FT/SEC/SEC
y_E	YE	
z_E	ZE	
α	A1	Target angle of attack (RAD.)
t'	G,GAM	Time at approximately 1000 feet to go
$C_{L_{\alpha_T}}$	CLA	Aerodynamic lift coefficient of target due to angle of attack
$\bar{V}_{TI}$	VTI	Target inertial velocity
ℓ/B	RLB	Apparent plume length to breadth ratio
E	________	Subscript which denotes earth fixed coordinates
ψ_L	________	Azimuth angle of target (DEG.)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
F	________	Subscript which denotes target fixed coordinates
L	________	Subscript which denotes launch coordinates
R_i	RI	Initial range (FT.)
R_{FT}	RFEET	Range (FT)
________	EDOT	Scaled γ/t'
ρ	PHO	Air density (SLUGS/FT^3)
γ_{min}	GGG	Minima of the overload function
K	SKK	Variable scale factor, $K=\begin{cases} 1 + \frac{\gamma t}{t'}, & t \leq t' \\ 1 + \gamma, & t > t' \end{cases}$
________	XX	Range table for data collection
________	XXS	Scaled range table (XX)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
I_{r7}	RN	For MICOM Hybrid, a uniform random number, RN ε (-1,1) For IRSS, iris ratio number 7
Cos (ε)	COSE	Cosine of angle between LOS and center line of target
$x_{ML} - x_{TL}$	DX	Scaled XXX, YYY, ZZZ (NOTE: these variables may overload on the AD/4 until time = t')
$y_{ML} - y_{TL}$	DY	
$z_{ML} - z_{TL}$	DZ	
t	DT	Real time
$x_{ML} - x_{TL}$	XXX	x-Missile minus x-target position (FT.)
$y_{ML} - y_{TL}$	YYY	y-Missile minus y-target position (FT.)
$z_{ML} - z_{TL}$	ZZZ	z-Missile minus z-target position (FT.)
$\dot{x}_{ML} - \dot{x}_{TL}$	XDOT	x-Missile minus x-target velocity (FT./SEC.)
$\dot{y}_{ML} - \dot{y}_{TL}$	YDOT	y-Missile minus y-target velocity (FT./SEC.)
$\dot{z}_{ML} - \dot{z}_{TL}$	ZDOT	z-Missile minus z-target velocity (FT./SEC.)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
$\dot{x}_{TL}$	XDTGMS	Tables of target velocity components in launch system
$\dot{y}_{TL}$	YDTGMS	
$\dot{z}_{TL}$	ZDTGMS	
β	———	$\cos^{-1}(L_y/\sqrt{L_x{}^2+L_y{}^2})$
h	ZALT	Altitude of missile above sea level (FT.)
———	XCOMP	Interpolated value of XDTGMS
———	YCOMP	Interpolated value of YDTGMS
———	ZCOMP	Interpolated value of ZDTGMS
$\dot{x}_{TE}$	XC	Interpolated value of XDM
$\dot{y}_{TE}$	YC	Interpolated value of YDM
$\dot{z}_{TE}$	ZC	Interpolated value of ZDM

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
———	XDM	Tables of target velocity components in earth system
———	YDM	
———	ZDM	
———	TIME	Storage for missile position, velocity and time in the region of pre-specified range table entries
———	PPX	
———	PPY	
———	PPZ	
———	VMX	
———	VMY	
———	VMZ	
———	IPTS	Number of points in range table
———	MISSED	An array of values representing miss conditions
———	T111	Angle between $(\overline{LOS}\times\overline{C}_L)$ and horizon reference vector

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
x_G	———	x-Missile minus x-target (in launch coordinates)
y_G	———	y-Missile minus y-target (in launch coordinates)
z_G	———	z-Missile minus z-target (in launch coordinates)
VT	VTI	Target inertial velocity
———	XTA	Interpolated target accelerations in earth fixed coordinate system
———	YTA	
———	ZTA	
$\bar{C}_L$	———	Longitudinal center line of target
C_{Lx}	G1	Components of $\bar{C}_L$ in earth fixed coordinates
C_{Ly}	G2	
C_{Lz}	G3	
$\bar{L}_{os}$	———	Line of sight vector

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
L_x	F1	Components of $\bar{L}_{os}$ in earth fixed coordinates
L_y	F2	
L_z	F3	
x_{ML}	———	x-Missile position in launch coordinates
y_{ML}	———	y-Missile position in launch coordinates
z_{ML}	———	z-Missile position in launch coordinates
x_{TL}	———	x-target position in launch coordinates
y_{TL}	———	y-target position in launch coordinates
z_{TL}	———	z-target position in launch coordinates
x_{TE}	———	x-position of target in inertial coordinates
y_{TE}	———	y-position of target in inertial coordinates
z_{TE}	———	z-position of target in inertial coordinates

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
———	XDTGO	Initial values of XDTGMS, YDTGMS, ZDTGMS
———	YDTGO	
———	ZDTGO	
H_{c7}	———	Commanded irradiance for plume
f	19.5	Focal length of projection lens (CM)
$H\Big\vert_{\varepsilon}^{R=7000}$	HR7E	Irradiance at 7000 meters (W/CM^2)
P_1	P1IRSS	Vertex angle of plume transparency (DEG)
P_2	P2IRSS	Length of plume transparency (IN.)
A_{t7}	AT7	Area of plume transparency (IN^2)
J_{tu7}	PJTU1	Available radiant intensity of target as function of plume transparency area taken from calibration in IRSS (W/STER)
$T_{f,plume}$	0.3	Neutral density transmission factor for plume

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
W_T	WT	Weight of target
S_T	ST	Reference surface area of target
$\bar{C}$	________	Horizon reference vector
Q_M	QM	Mach number of target
a_s	AAA	Speed of sound
V_2	________	Speed of flare
R_F	________	Range to go between missile and flare
H_{i2}, H_{c2}	________	Irradiance of flare W/CM^2 (Note, letter c denotes calibration)
$\dot{X}_{FL}$	________	Velocity of flare in launch coordinates (FT/SEC)
$\dot{Y}_{FL}$	________	
$\dot{Z}_{FL}$	________	
σ_{Y4}	________	Approximate ψ_4 (RAD)
σ_{Z4}	________	Approximate θ_4 (RAD)
σ_{Y2}	σ_{YT}	Approximate ψ_2 (RAD)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
σ_{Z2}	σ_{ZT}	Approximate θ_2 (RAD)
———	J_{tu2}	Available radiant intensity of flare
———	T_{FD}	Time of flare drop (SEG)
$\lvert L_{os} \rvert$	R	Norm of line of sight (FT)
t_{FD}	t_{FD}, t_{fd}	Time associated with flare drop
δ	———	Missile wing deflection
ψ_2	ψ_{F2}	Flare azimuth (DEG)
ψ_4	ψ_{T4}	Tail pipe azimuth (DEG)
ψ_7	ψ_{T7}	Plume azimuth (DEG)
ψ_{24}	ψ_{T2REL}	
θ_2	θ_{T2}	Flare elevation (DEG)
θ_4		Tail pipe elevation (DEG)
θ_7	θ_{T7}	Plume elevation (DEG)
θ_{24}		
$\dot{\psi}_2$	$\dot{\psi}_{F2}$	Flare azimuth rate (DEG/SEC)
$\dot{\psi}_4$	$\dot{\psi}_{T4}$	Tail pipe azimuth rate (DEG/SEC)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
$\dot{\psi}_7$	$\dot{\psi}_{T7}$	Plume azimuth rate (DEG/SEC)
$\dot{\psi}_{24}$	$\dot{\psi}_{T2REL}$	
$\dot{\theta}_2$	$\dot{\theta}_{T2}$	Flare elevation rate (DEG/SEC)
$\dot{\theta}_4$	$\dot{\theta}_{T4}$	Tail pipe elevation rate (DEG/SEC)
$\dot{\theta}_7$	$\dot{\theta}_{T7}$	Plume elevation rate (DEG/SEC)
$\dot{\theta}_{24}$	$\dot{\theta}_{T2REL}$	
t_2	———	Transparency radius for flare } used to command true size
t_4	———	Transparency radius for tailpipe } used to command true size
P	θ	GUM pitch angle (DEG)
Y	ψ	GUM yaw angle (DEG)
R	ϕ	GUM roll angle (DEG)
r'	———	GUM Yaw rate (DEG/SEC)
q'	———	GUM pitch rate (DEG/SEC)
p'	———	GUM roll rate (DEG/SEC)

VARIABLE	PROGRAM SYMBOL	DESCRIPTION
______	NPATH	Flag to control entrance into computation loop of real-time code.
______	LOOP1	Loop counter for real-time interrupts prior to sense line 6 coming high
______	LOOP2	Loop counter for real-time interrupts after sense line 6 comes high
______	INFLRT	Flag to signal entrance into real time, INFLRT = -1 indicates batch and INFLRT = +1 indicates entrance into real-time
______	LTF	Clock time at beginning of real-time loop. This value is used later to compute specific loop time for each loop
______	NSEG	Segment number of real-time code which is to be entered.
______	IT1	
______	INDEX	Index for storing real-time data for post real-time analysis
______	LEVEL	Status of maneuver -7 → not in real-time 0 → in real-time +7 → target trajectory table exceeded
______	IT1, IT2	Index used in interpolation of target trajectory time
______	NT	Length for target trajectory tables

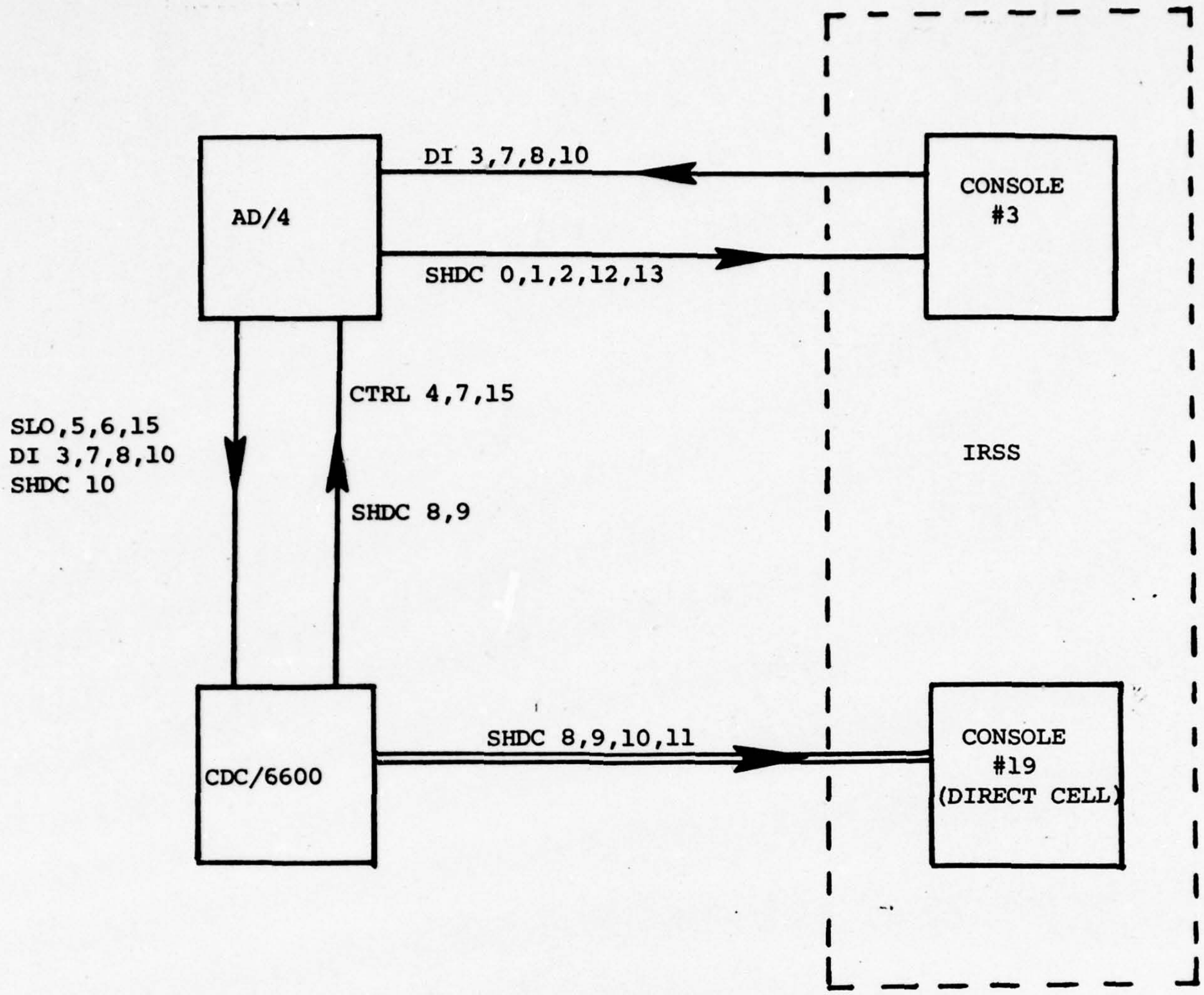
VARIABLE	PROGRAM SYMBOL	DESCRIPTION
________	DXG	
________	DYG	
________	DZG	Dummy storage location for current value of DX, DY, DZ, XDOT, YDOT and ZDOT respectively. These variables are returned to the main program for diagnostic purposes
________	XDO	
________	YDO	
________	ZDO	
L	PL	Actual plume length (FT)
B	PB	Actual plume breadth at base (FT)
ℓ	PLA	Apparent plume length
________	t	MAN(1,I)
________	$\dot{X}_{TL}$	MAN(2,I) Target time and
________	$\dot{Y}_{TL}$	MAN(3,I) velocity at each range table data
________	$\dot{Z}_{TL}$	MAN(4,I) collection point

V. REAL-TIME I/O

B&K DYNAMICS, INC.

V. REAL-TIME I/O

This Section contains a description of real-time input output requirements of the MICOM Hybrid STINGER Simulation. The tables and figures included in this section describe the flow of analog and discrete information between an AD/4 analog computer, a CDC/6600 digital computer and the IRSS.



NOTE: The CTRL and SL word are also used to transmit SHDCS and DIs, the specific usage is:

- o SHDC 8 = CTRL 8
- o SHDC 9 = CTRL 9
- o SHDC 10 = SL 11
- o SHDC 11 = CTRL 11
- o DI 3 = SL 3
- o DI 7 = SL 7
- o DI 8 = SL 8
- o DI 10 = SL 10

FIGURE 5.1

DISCRETE CIRCULATION

V60	V61	V60	V61	V62	V63	V62	V63
00	10	20	30	40	50	60	70
01	11	21	31	41	51	61	71
02	12	22	32	42	52	62	72
03	13	23	33	43	53	63	73
04	14	24	34	44	54	64	74
05	15	25	35	45	55	65	75
06	16	26	36	46	56	66	76
07	17	27	37	47	57	67	77
I	O	I	O	I	O	I	O

$\underbrace{\text{I} \quad \text{O} \quad \text{I} \quad \text{O}}_{\text{VARIABLE 1}} \qquad \underbrace{\text{I} \quad \text{O} \quad \text{I} \quad \text{O}}_{\text{VARIABLE 2}}$

For Variable 2 (MSB at left, LSB at right):

	MSB														LSB
Input to CDC-6600	40	41	42	43	44	45	46	47	60	61	62	63	64	65	66	67
Output from CDC-6600	50	51	52	53	54	55	56	57	70	71	72	73	74	75	76	77

For Variable 1:

Input to CDC-6600	00	01	02	03	04	05	06	07	20	21	22	23	24	25	26	27
Output from CDC-6600	10	11	12	13	14	15	16	17	30	31	32	33	34	35	36	37

FIGURE 5.2

AD/4 DISCRETE TRUNK LINE CONNECTIONS

TABLE 5.1
DISCRETE SIGNALS FROM AD/4 TO CDC/6600

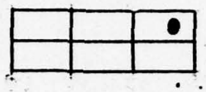
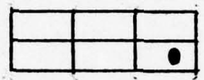
AD/4 PATCH	CDC/6600 BIT	DESCRIPTION	ORIGIN	ULTIMATE DESTINATION
TR4	SL11	NORMAL TERMINATION (SHDC10), SIGNALS RAMP DOWN COMPLETE	AD/4	IRSS/19
TR27	SL0	LOOP TO BATCH, RETRANSMITTS ICs WHEN SET LOW	AD/4	6600
TR22	SL5	STATIC TEST OK, SIGNALS AD/4 READY TO RECEIVE IC 	AD/4	6600
TR21	SL6	RAMP UP READY, SET HIGH BY OPERATE SWITCH IN MICOM HYBRID,  THIS STARTS REAL TIME LOOPING	AD/4	6600
TR00	SL15	6600 ABNORMAL ABORT, USED TO EXIT REAL TIME LOOPING	AD/4	6600
TR24	SL3	IRSS READY (DI3)	IRSS	6600
TR20	SL7	END OF PROBLEM (DI7)	IRSS	AD/4 6600
TR7	SL8	EMERGENCY SHUTDOWN (DI8)	IRSS	AD/4 6600
TR5	SL10	INITIAL FIELD REQUEST (DI10)	IRSS	6600

TABLE 5.2 DISCRETE SIGNALS FROM AD/4 TO IRSS

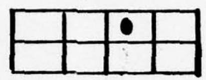
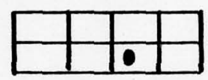
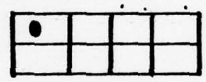
AD/4 PATCH	IRSS BIT	DESCRIPTION	ORIGIN	ULTIMATE DESTINATION
T46	SHDC0	SHUTTER #2 COMMAND	AD/4	IRSS/3
T61	SHDC1	SHUTTER #4 COMMAND	AD/4	IRSS/3
T63	SHDC2	SHUTTER #7 COMMAND	AD/4	IRSS/3
-----	SHDC8	SIMULATION RUNNING, (THIS PATH NOT USED SEE CTRL8)	-----	-----
-----	SHDC9	FIELD TRANSMITTED, (THIS PATH NOT USED SEE CTRL9)	-----	-----
-----	SHDC10	NORMAL TERMINATION, (THIS PATH NOT USED SEE SL11)	-----	-----
T43	SHDC12	TARGET AQUIRED	AD/4	IRSS/3
T40	SHDC13	DISCRETE #5, SWITCH SEEKER FROM EXTERNAL TO INTERNAL POWER	AD/4	IRSS/3

NOTE: IRSS/3 IS IRSS CONSOLE 3 AND IRSS/19 IS IRSS CONSOLE 19, THE DIRECT CELL DATA LINK

TABLE 5.3 DISCRETE SIGNALS FROM IRSS TO AD/4

AD/4 PATCH	IRSS BIT	DESCRIPTION	ORIGIN	ULTIMATE DESTINATION
T72	DI3	IRSS READY, NOT SENT UNTIL TARGET ACQUIRED SIGNAL IS RECEIVED	IRSS	6600
T56	DI7	END OF PROBLEM, SIGNALS EQUIPMENT SHUT DOWN IN IRSS	IRSS	AD/4 6600
T55	DI8	EMERGENCY SHUT DOWN, SIGNALS EXCESSIVE ACCELERATION IN GUM	IRSS	AD/4 6600
T53	DI10	INITIAL FIELD REQUEST	IRSS	6600

TABLE 5.4 DISCRETE SIGNALS FROM CDC/6600 TO AD/4 OR IRSS

AD/4 PATCH	CDC/6600 BIT	DESCRIPTION	ORIGIN	ULTIMATE DESTINATION
TR33	CTRL4	ICs SENT, 	6600	AD/4
TR30	CTRL7	INTECEPT DETECTED, SET HIGH BY INTERCEPT OR MISS CONDITION 	6600	AD/4
TR10	CTRL15	REAL TIME LOOPING, SIGNALS CDC/6600 WAITING FOR SL6 HIGH 	6600	AD/4
TR16	CTRL9	FIELD TRANSMITTED (SHDC9) SIGNAL TO GEPAC THAT FIRST FRAME OF DATA IS AVAILABLE. THIS OCCURS AFTER THE 6600 HAS RECEIVED INITIAL FIELD REQUEST, DI10	6600	IRSS/19 AD/4
TR17	CTRL8	SIMULATION RUNNING (SHDC8) TURNS ON INDICATOR LIGHTS ONLY. SENT WITH SHDC11	6600	IRSS/19 AD/4
-----	CTRL11	START SIMULATION (SHDC11) IN CLOSED-LOOP GEPAC RESPONDS BY SENDING FIRST CLOCK PULSE. SENT WITH SHDC8	6600	IRSS/19

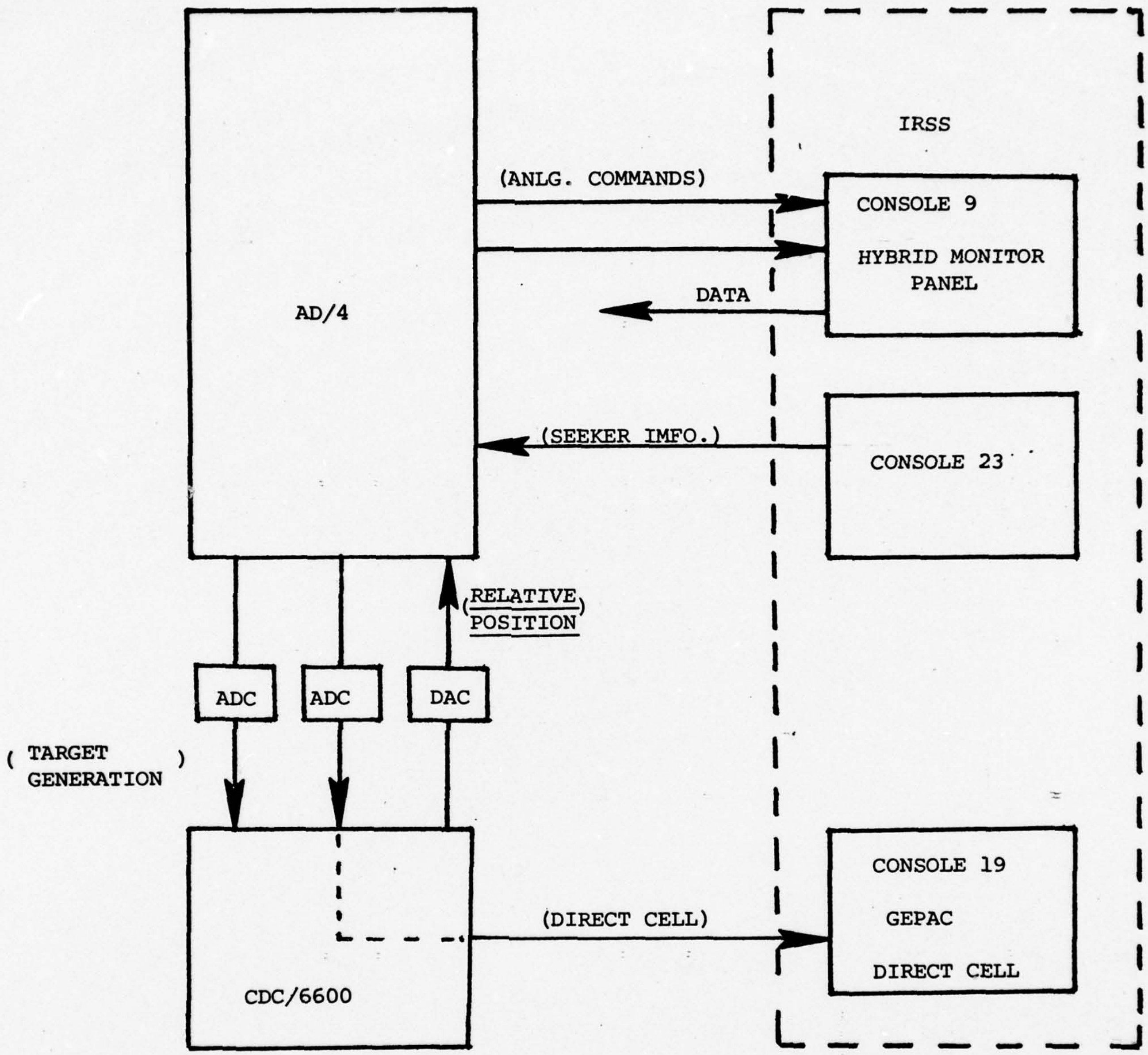


FIGURE 5.3 ANALOG SIGNAL CIRCULATION

0	1
2	3

SEEKER DATA TO AD/4				TO 231R			
10		30	TAB	50		70	
11		31	SYNC FILT	51		71	
12		32	ACQ.	52		72	
13		33		53		73	
14		34		54		74	
15	δ_{wi}	35		55		75	
16	GUID COMD.	36		56		76	
17	TAG	37		57		77	

ADCs to GEPAC				ADCs TO 6600			
10	t_2	30	ψ_2	50	$\dot{x}_{TL}$	70	γ/t'
11	t_4	31	θ_2	51	$\dot{y}_{TL}$	71	θ_L
12	P2	32	ψ_4	52	$\dot{z}_{TL}$	72	i_7
13	R	33	θ_4	53	ℓ/B	73	
14	P1	34	ψ_7	54	$\cos(\varepsilon)$	74	
15	i_2	35	θ_7	55	T_{RP}	75	
16	i_4	36	P	56	R_i	76	
17	i_7	37	Y	57	t'	77	

AD/4 COMMANDS TO IRSS/9				DACS TO 6600			
10		30	$\dot{\theta}_2$	50		70	$x_{ML}-x_{TL}$
11	$\dot{\psi}_2$	31		51	$x_{ML}-x_{TL}$	71	$y_{ML}-y_{TL}$
12		32	$\dot{\theta}_4$	52	$y_{ML}-y_{TL}$	72	$z_{ML}-z_{TL}$
13	$\dot{\psi}_4$	33		53	$z_{ML}-z_{TL}$	73	
14		34		54	t	74	
15		35	$\dot{\theta}_7$	55	$\dot{x}_{ML}-\dot{x}_{TL}$	75	
16	$\dot{\psi}_7$	36		56	$\dot{y}_{ML}-\dot{y}_{TL}$	76	
17		37		57	$\dot{z}_{ML}-\dot{z}_{TL}$	77	

TO 231 R				AD/4 COMMANDS TO IRSS/9			
10		30		50		70	
11		31		51	T_{RP}	71	
12		32		52		72	
13		33		53		73	
14		34		54	r'	74	
15		35		55	q'	75	
16		36		56	p'	76	
17		37		57		77	

FIGURE [illegible].4 AD/4 TRUNKLINE PATCHING

TABLE 5.5 AD/4 - CDC/6600 ADC ASSIGNMENT (V13 → ___)

ANALOG VARIABLE NAME	AD/4 ANLG. VOLTAGE $-100<V<+100$	DIGITAL FRACTION $-1<N<+1$	RELATIVE ADC ASSIGN.	AD/4 TRUNK LINE ASSIGNMENT
DX	$\frac{K(X_{ML}-X_{TL})}{20}$	$\frac{K(X_{ML}-X_{TL})}{(20)(100)}$	2	151
DY	$\frac{K(Y_{ML}-Y_{TL})}{20}$	$\frac{K(Y_{ML}-Y_{TL})}{(20)(100)}$	3	152
DZ	$\frac{K(Z_{ML}-Z_{TL})}{20}$	$\frac{K(Z_{ML}-Z_{TL})}{(20)(100)}$	4	153
DT	10t	$\frac{10t}{(100)}$	5	154
XDOT	$\frac{\dot{X}_{ML}-\dot{X}_{TL}}{200}$	$\frac{\dot{X}_{ML}-\dot{X}_{TL}}{(200)(100)}$	6	155
YDOT	$\frac{\dot{Y}_{ML}-\dot{Y}_{TL}}{200}$	$\frac{\dot{Y}_{ML}-\dot{Y}_{TL+}}{(200)(100)}$	7	156
ZDOT	$\frac{\dot{Z}_{ML}-\dot{Z}_{TL}}{200}$	$\frac{\dot{Z}_{ML}-\dot{Z}_{TL}}{(200)(100)}$	8	157

(ADC ASSIGNMENT CONTINUED)

ANALOG VARIABLE NAME	AD/4 ANLG. VOLTAGE $-100<V<+100$	DIGITAL FRACTION $-1<N<+1$	RELATIVE ADC ASSIGNMENT	AD/4 TRUNK LINE ASSIGNMENT
XXX	$\frac{K(X_{ML}-X_{TL})}{200}$	$\frac{K(X_{ML}-X_{TL})}{(200)(100)}$	9	170
YYY	$\frac{K(Y_{ML}-Y_{TL})}{200}$	$\frac{K(Y_{ML}-Y_{TL})}{(200)(100)}$	10	171
ZZZ	$\frac{K(Z_{ML}-Z_{TL})}{200}$	$\frac{K(Z_{ML}-Z_{TL})}{(200)(100)}$	12	173

TABLE 5.6 AD/4 - CDC/6600 DAC ASSIGNMENT (V15 → ___)

DIGITAL VARIABLE NAME	DIGITAL FRACTION $-1<N<+1$	AD/4 ANLG. VOLTAGE $-10<V<+10$	RELATIVE DAC ASSIGNMENT	AD/4 TRUNK LINE ASSIGNMENT
XDTGO,XCOMP	$\frac{\dot{X}_{TL}}{(200)(10)}$	$\frac{\dot{X}_{TL}}{200}$	1	250
YDTGO,YCOMP	$\frac{\dot{Y}_{TL}}{(200)(10)}$	$\frac{\dot{Y}_{TL}}{200}$	2	251
ZDTGO,ZCOMP	$\frac{\dot{Z}_{TL}}{(200)(10)}$	$\frac{\dot{Z}_{TL}}{200}$	3	252
RLB	$\frac{(\ell/B)}{(10)}$	ℓ/B	4	253
COSE	$\frac{10\cos(\varepsilon)}{10}$	$10 \cos(\varepsilon)$	5	254
SPO	$\frac{T_{RP}}{10}$	T_{RP}	6	255
RI	$\frac{R_i}{(2000)(10)}$	$\frac{R_i}{2000}$	7	256

(DAC ASSIGNMENT CONTINUED)

DIGITAL VARIABLE NAME	DIGITAL FRACTION -1 N +1	AD/4 ANLG. VOLTAGE -10 V +10	DAC ASSIGNMENT	AD/4 TRUNK LINE ASSIGNMENT
GAM	$\frac{t'}{10}$	t'	8	257
EDOT	$\frac{(\gamma/t')}{(.6)(10)}$	$\frac{5(\gamma/t')}{3}$	9	270
THETAL	$\frac{\theta_L}{(10)(10)}$	$\frac{\theta_L}{10}$	10	271
RN	$\frac{10.741\ i_7}{10}$	$10.741\ i_7$	12	273
RN*	$\frac{R_n}{10}$	R_n	12	273

* FOR MICOM HYBRID APPLICATIONS

TABLE 5.7 COMMANDS TO IRSS/9
U01←W9X28A

ANALOG VARIABLE NAME	AD/4 ANALOG VOLTAGE	RELATIVE TRUNK ASSIGNMENTS	AD/4 TRUNK LINE ASSIGNMENTS
$\dot{\theta}_7$	$-.875\ \dot{\theta}_7$	14	235
$\dot{\psi}_7$	$-.875\ \dot{\psi}_7$	7	216
$\dot{\theta}_2$	$-.875\ \dot{\theta}_2$	9	230
$\dot{\psi}_4$	$+.875\ \dot{\psi}_4$	4	213
$\dot{\theta}_4$	$-.875\ \dot{\theta}_4$	11	232
$\dot{\psi}_2$	$-.875\ \dot{\psi}_2$	2	211

TABLE 5.8 COMMANDS TO IRSS/9

V17 - U02←W9X28A

ANALOG VARIABLE NAME	AD/4 ANALOG VOLTAGE	RELATIVE TRUNK ASSIGNMENTS	AD/4 TRUNK LINE ASSIGNMENTS
r' (YAW RATE)	1.0 r'	5	354
q' (PITCH RATE)	1.0 q'	6	355
p' (ROLL RATE)	13.8×10^{-3} p'	7	356
T_{RP}	.5555 T_{RP}	2	351

TABLE 5.9 IRSS/23 TO AD/4 (seeker outputs)
V14-400←W23X28C

ANALOG VARIABLE NAME	AD/4 ANALOG VOLTAGE	RELATIVE TRUNK ASSIGNMENT	AD/4 TRUNK LINE ASSIGNMENT
$\delta_{\omega i}$	$.5435\ \delta_{\omega i}$	6	015
Guid. Comd.	----------	7	016
TAG	----------	8	017
TAB	----------	9	030
Sync Filt	----------	10	031
Acquisition	----------	11	032

TABLE 5.10 AD/4 TO CDC/6600
(sent to IRSS via direct cell)

V12→

ANALOG VARIABLE NAME	AD/4 ANALOG VOLTAGE	RELATIVE ADC ASSIGNMENT	AD/4 TRUNK LINE ASSIGNMENT
t_2	$9.53\text{X}10^3 t^2$	1	110
t_4	$9.534\text{X}10^3 t_4$	2	111
P_2	$9.896\text{X}10^2 P_2$	3	112
R	.5555 R	4	113
P_1	$1.7255\ P_1$	5	114
i_2	$10.742\ i_2$	6	115
i_4	$10.742\ i_4$	7	116
i_7	$10.741\ i_7$	8	117
ψ_2	$1.1111\ \psi_2$	9	130
θ_2	$3.333\ \theta_2$	10	131
ψ_4	$1.111\ \psi_4$	11	132
θ_4	$3.333\ \theta_4$	12	133
ψ_7	$1.111\ \psi_7$	13	134
θ_7	$3.333\ \theta_7$	14	135
P	1.25 P	15	136
Y	1.111 Y	16	137

VI. SUBROUTINE KSCALE

VI. SUBROUTINE KSCALE

This subroutine estimates t', the time at 1000 feet-to-go for target missile intercept and computes the overload function for real-time variable scale factors. The estimates are based on a simplified model involving a constant bearing course and a nomial missile/target trajectory.

In addition, the program computes γ min - the minimal of the overload function, t γ min - the time at which γ min occurs and the smallest bit ADC resolution for relative missile positions.

EQUATIONS:

- $$\theta_2 = \tan^{-1}\left(\frac{t' \quad y_{TL}(0)^2 + Z^2_{TL}(0)}{R_i - 1000 + t' x_{TL}(0)}\right)$$

- $$R_i - \Delta R \cos(\theta_2) - 1000 + t' \, x_{TL}(0) = 0$$

(Note, the interative solution of this equation yields t')

- $$K_p = -x_{L1m}/R_i = +20,000/R_i \rightarrow K_p R_i = 20,000$$

- $$K_p R_i = \left(1 + \frac{\gamma min \; t\gamma \; min}{t'}\right)\left(R_i + x_{TL}(0) \; t_{\gamma min} - \Delta R_{min} \cos \theta_2\right)$$

or

$$\gamma \; min = \frac{1}{t \gamma \; min}\left(\frac{20,000 \; t'}{(R_i + x_{TL}(0) \; t_{\gamma \; min} - \Delta R_{min} \cos \theta_2)} - t'\right)$$

- $$\frac{d\gamma_{min}}{t_{\gamma \; min}} = At^2_{\gamma \; min} + Bt_{\gamma \; min} + C = 0$$

(Note, the interative solution of this equation yields $t_{\gamma \; min}$)

- $$A = \dot{x}^2_{TL}(0)$$

- $$B = 2 \, \dot{x}_{TL}(0) \; (20,000 - R + \Delta R_{min} \cos \theta_2) - 20,000 \; V_m \cos(\theta_2)$$

- $$C = (R - \Delta R_{min} \cos \theta_2)(20,000 - R + \Delta R_{min} \cos \theta_2)$$

- $$\gamma_{min} = -\left(\frac{20{,}000}{R_i + \dot{X}_{TL}(0)\, t\, \gamma_{min} - \Delta R \cos \theta_2} + 1\right)\left(\frac{t'}{t\ \gamma min}\right)$$

- $$A2 = \frac{(\Delta \text{Voltage})\ (\text{Analog Scale Factor for DX})}{1 + \gamma_{min}}$$

Here Δ Voltage is the analog voltage change resulting from a smallest bit change in the associated DAC.

$$\left.\begin{array}{l} \Delta V = .024 \\ \text{Analog Scale Factor} = 20 \end{array}\right\} \begin{array}{l}\text{Typical}\\ \text{Values}\end{array}$$

AD-A052 676 B-K DYNAMICS INC ROCKVILLE MD F/G 9/2

SUMMARY REPORT OF STINGER CONVERSION ACTIVITIES.(U)

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2 OF 4

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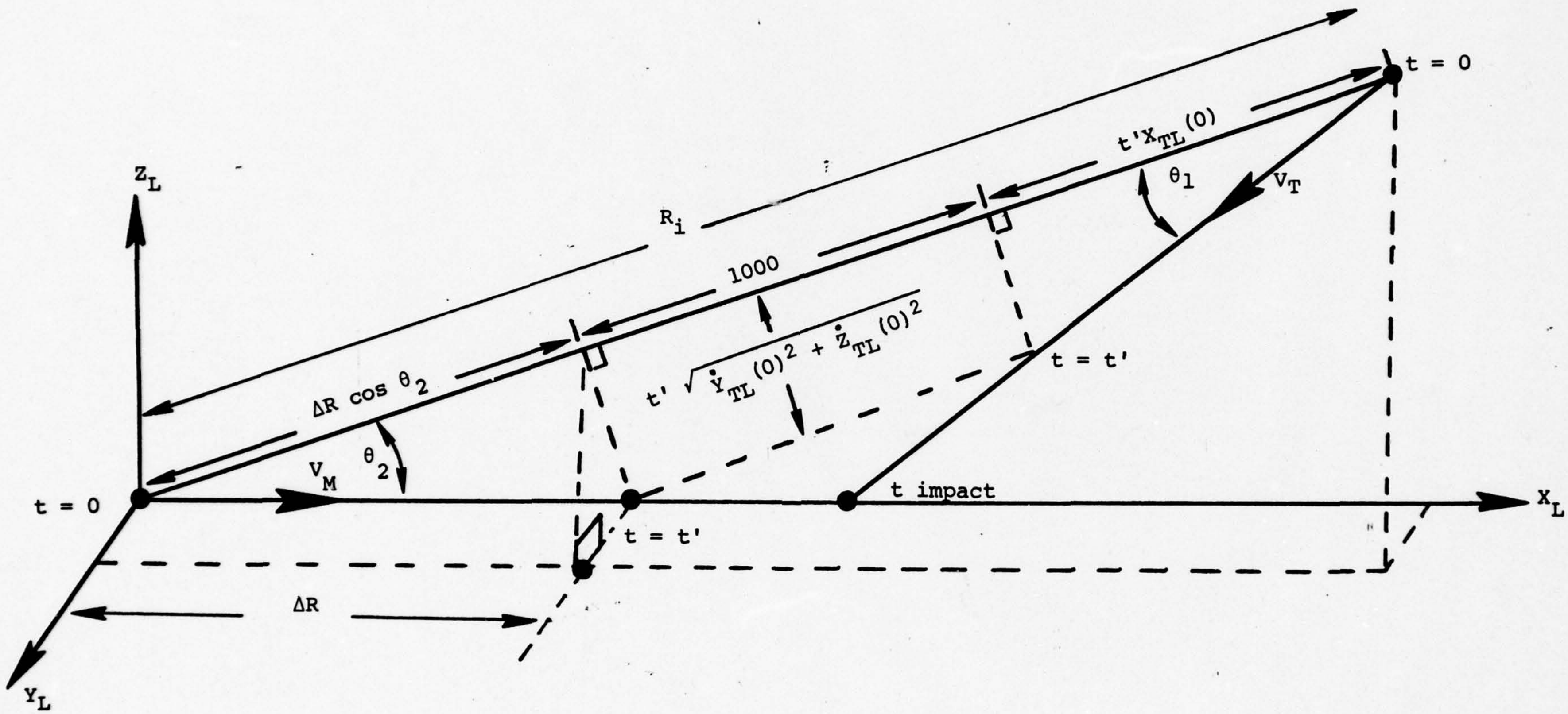


SIMPLIFIED GEOMETRY FOR ESTIMATING TARGET-MISSILE Intercept

FIGURE 6.1

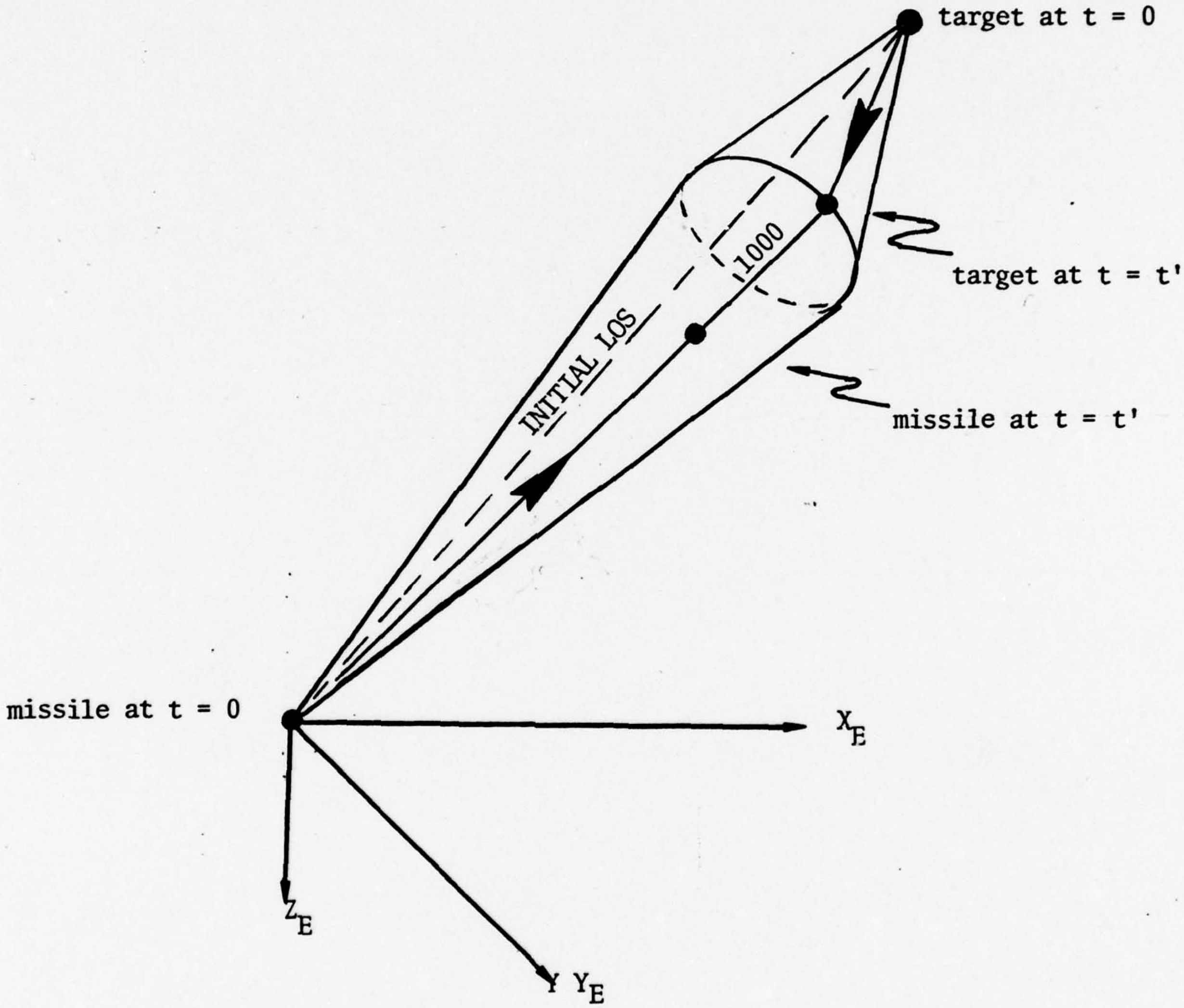


FIGURE 6.2 TYPICAL TARGET/MISSILE POSITION AT TIME $t = t_0$ and $t = t'$

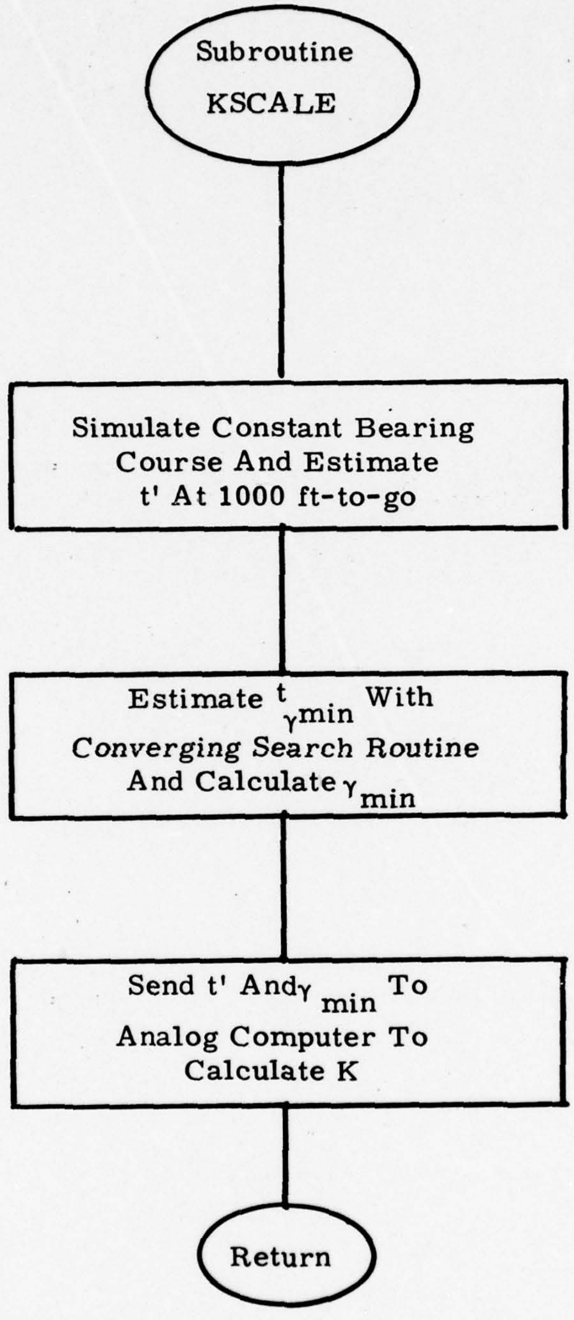


FIGURE 6.3

OVERVIEW OF SUBROUTINE KSCALE

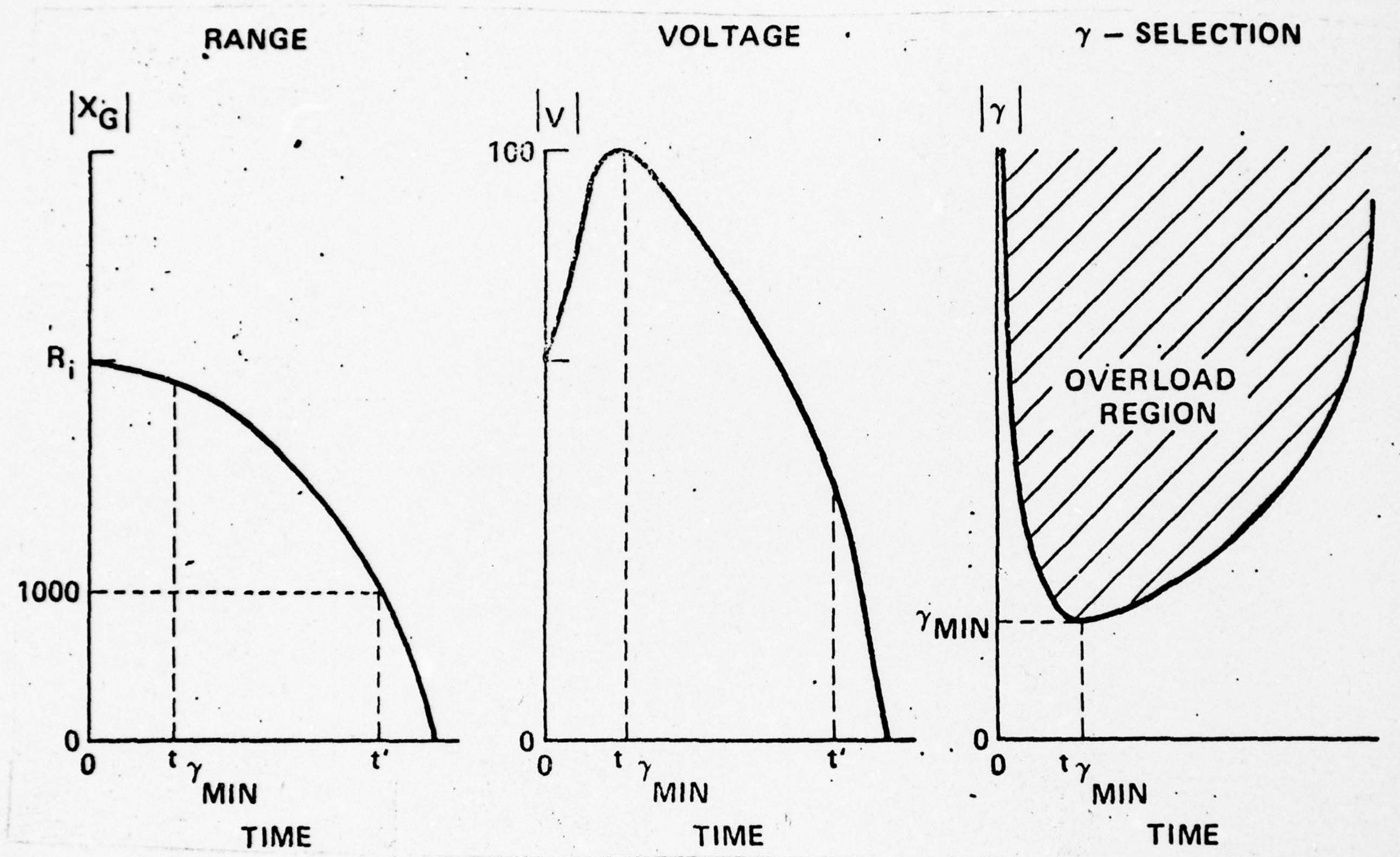
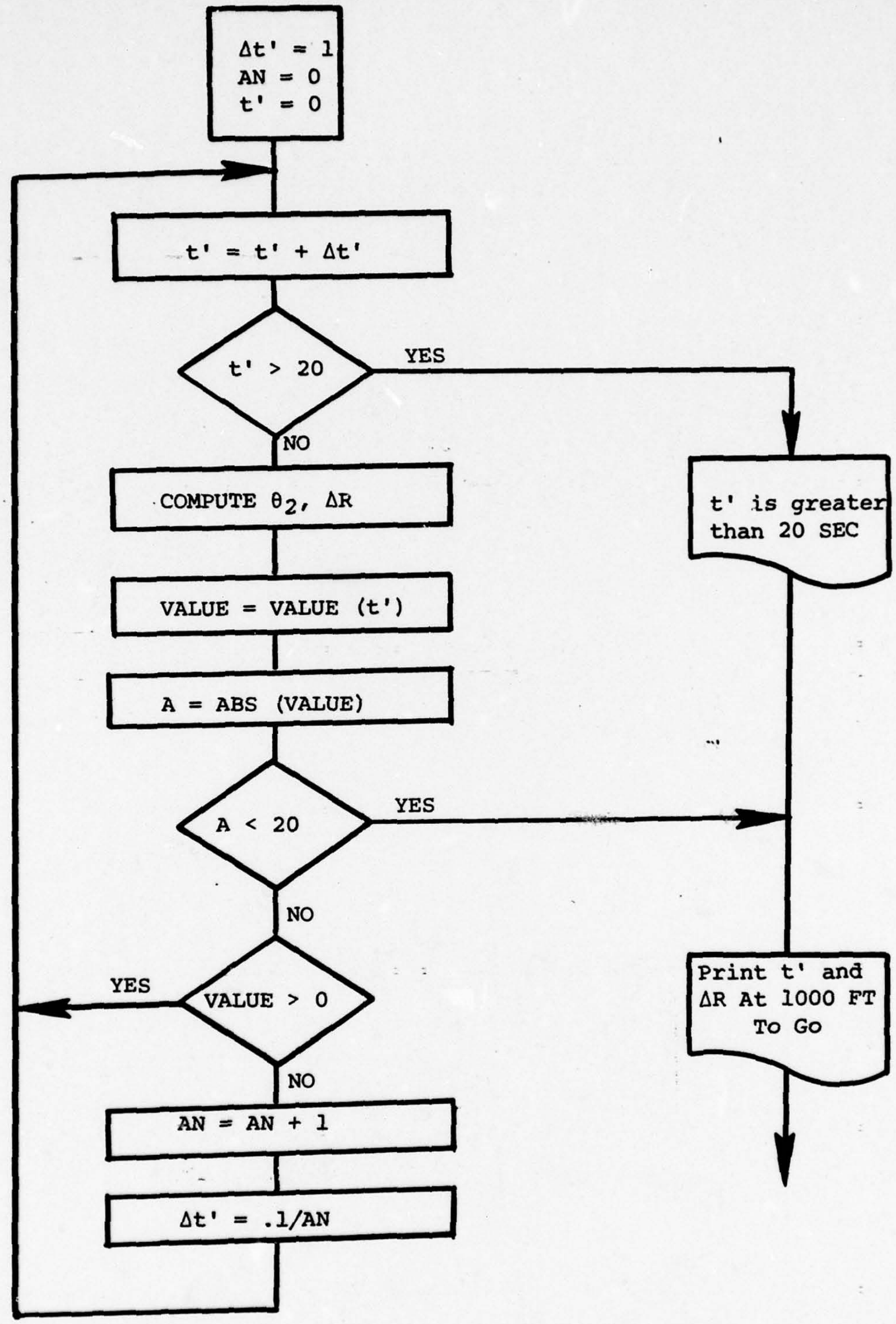


FIGURE 6.4
SELECTION CRITERIA



CONVERGING SEARCH FOR t' AT 1000 FT TO GO

FIGURE 6.5

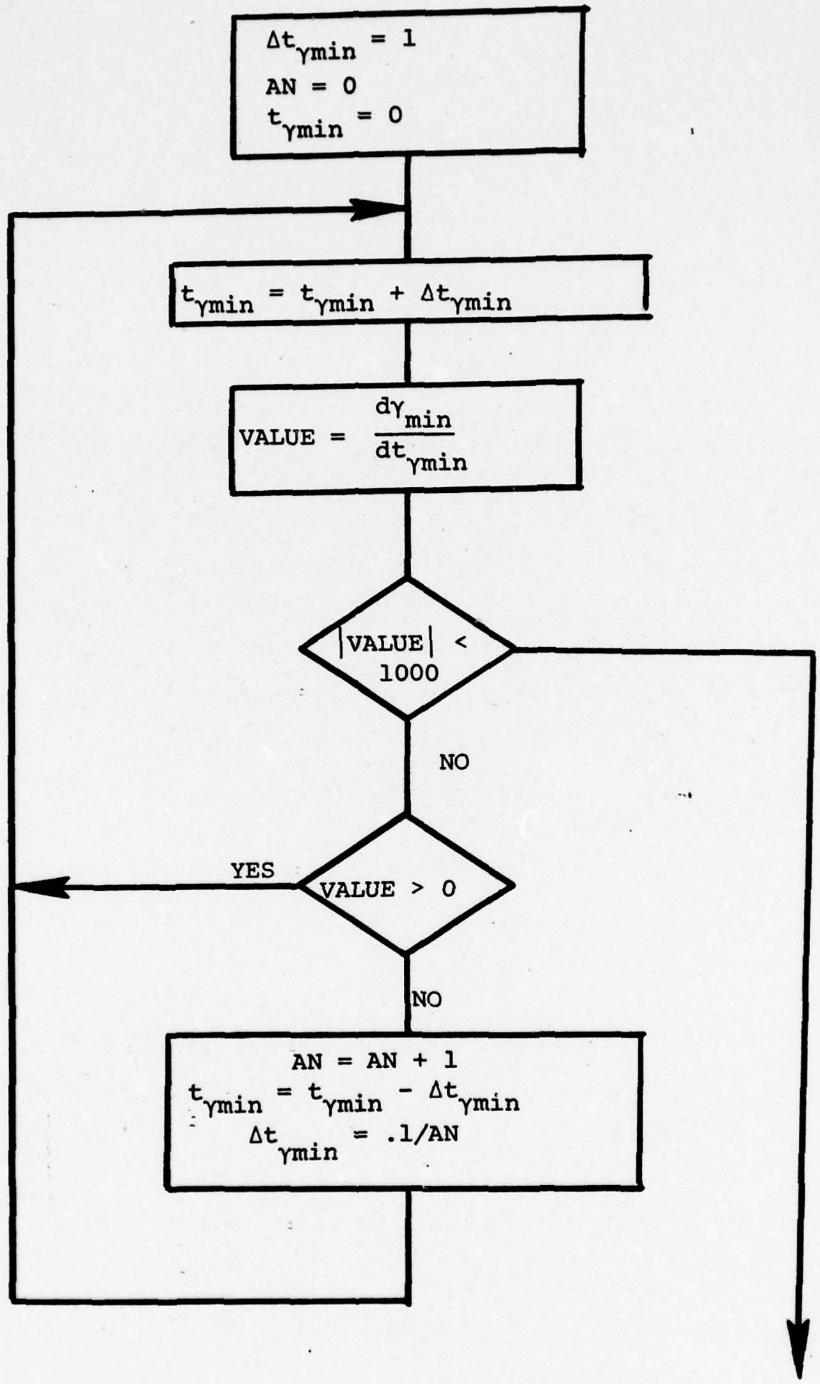
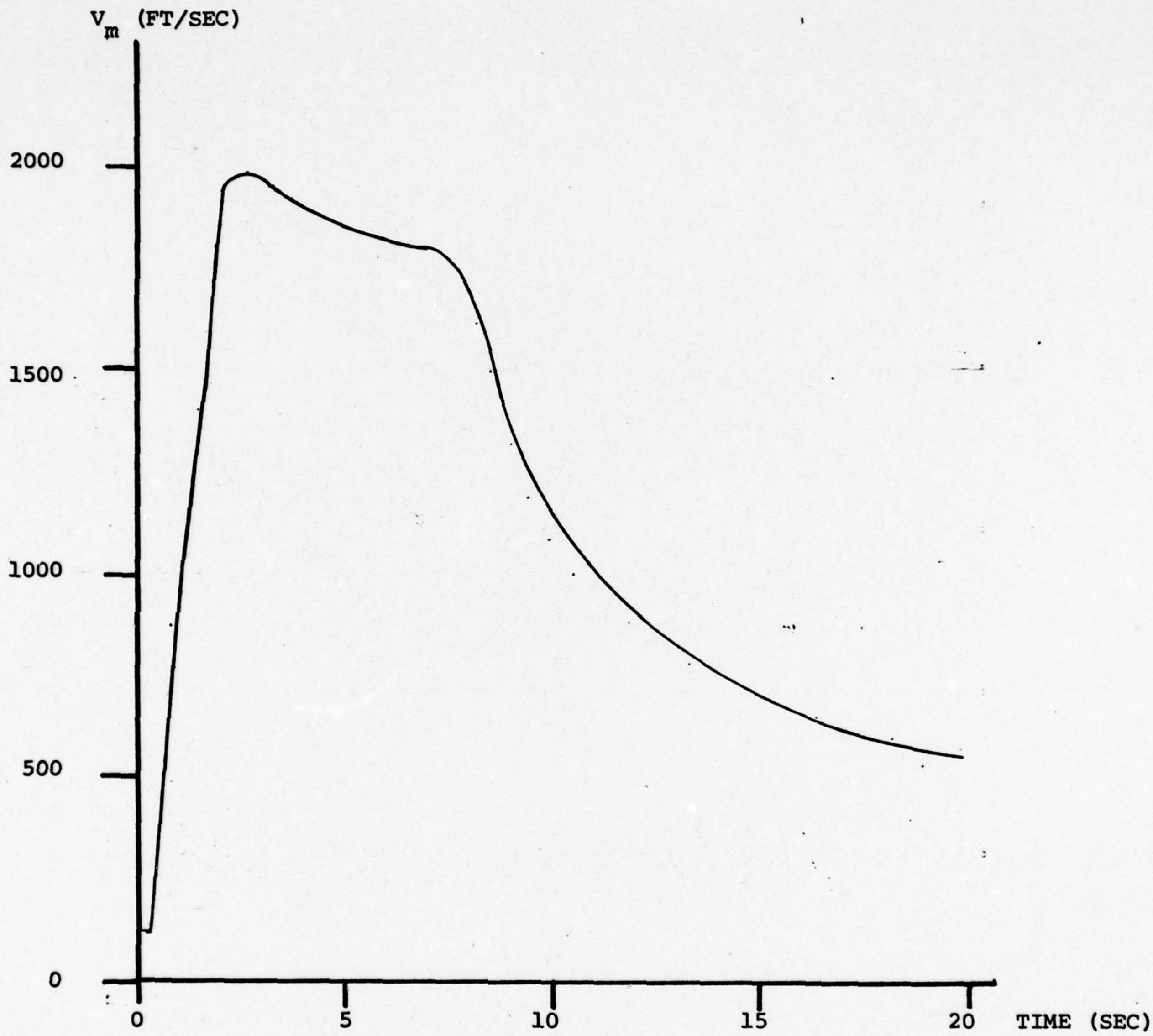


FIGURE 6.6
CONVERGING SEARCH FOR γ_{min}



VELOCITY VS TIME FOR
NOMINAL STINGER TRAJECTORY

FIGURE 6.7

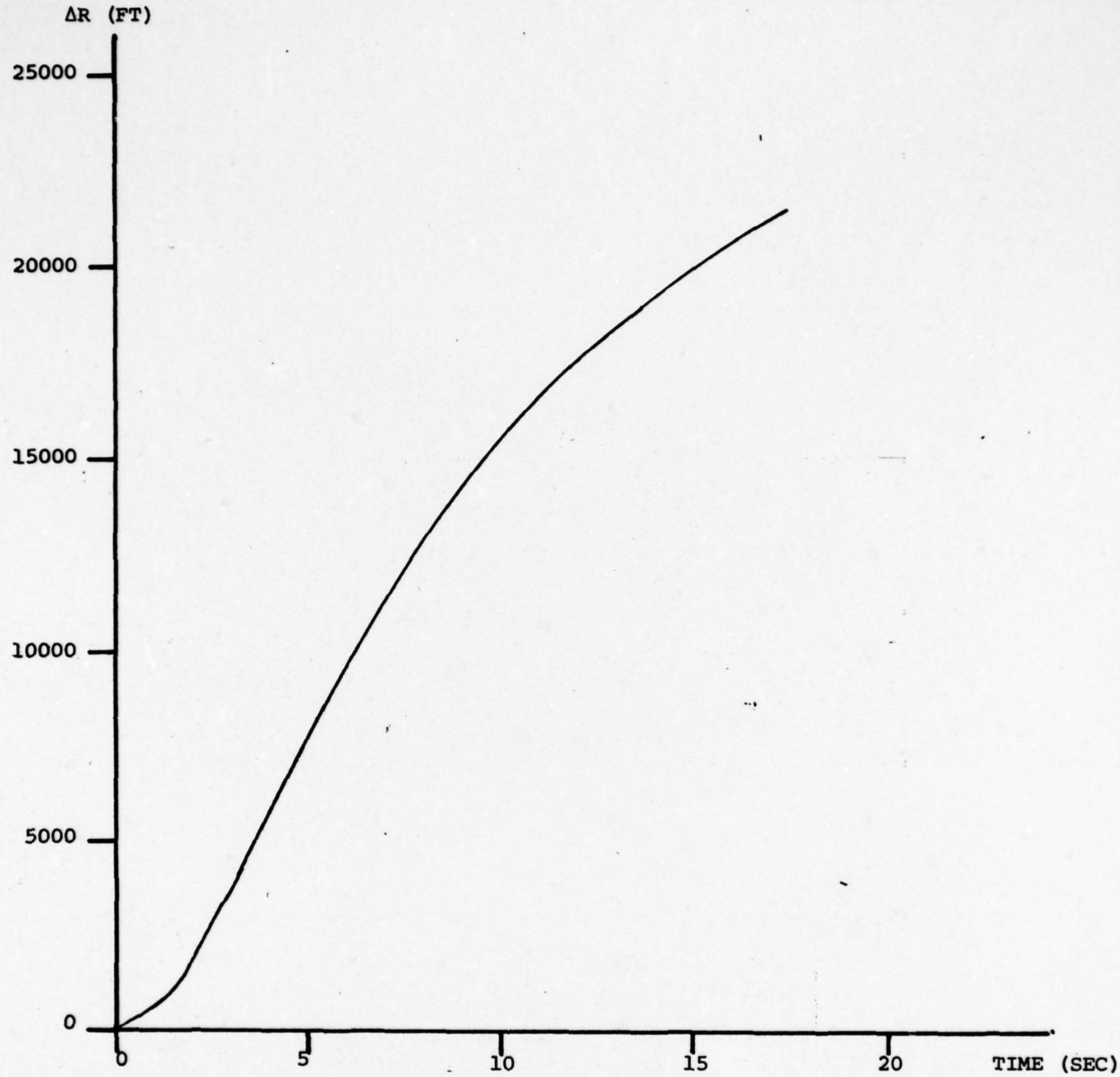


FIGURE 6.8
DISTANCE VS TIME FOR
NOMINAL STINGER TRAJECTORY

TABLE 6.1 DESCRIPTION OF SYMBOLS FOR SUBROUTINE KSCALE

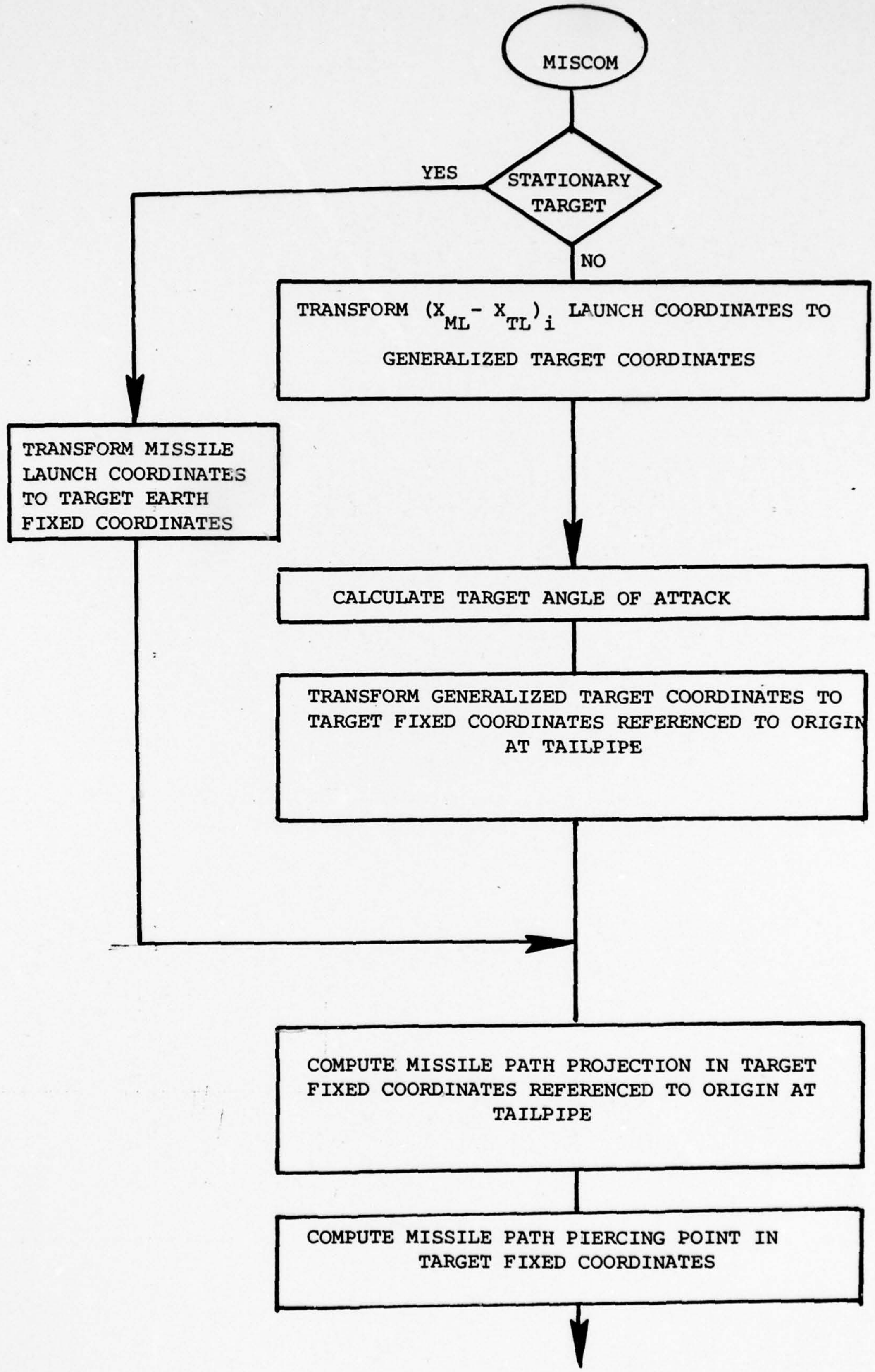
PROGRAM VARIABLE	SYMBOL	DESCRIPTION
EDOT	γ/t'	γ/t'
RI	R_i	Initial range (FT)
G	t'	Time at approximately 1000 feet to go
GG	$t_{\gamma min}$	
GGG	γ_{min}	Minima of the overload function, obtained by iterative solution
IS1		Print flag, IS1 $\neq$ 1 indicates print is desired
THETA1	θ_1	See Figure titled Simplified Geometry for Estimating Target-Missile intercept.
THETA2	θ_2	
XDTGO	$\dot{X}_{TL}(0)$	Initial components of target velocity in launch coordinates
YDTGO	$\dot{Y}_{TL}(0)$	
ZDTGO	$\dot{Z}_{TL}(0)$	
DG	$\Delta t', \Delta t_{\gamma min}$	Time increment in t' search
AN	-----	Scale factor for decrementing Δt as the search is refined
DELTAR(I)	$\Delta R(t_m)$	Distance missile has flown along nominal trajectory
VM(I)	$V_m(t_m)$	Velocity of missile for a nominal trajectory
TAMA(I)	t_m	Time table for the above nominal trajectories
	k_p	Maximum analog voltage = 100v
NB	-----	Length of nominal trajectory tables TAMA, VM and DELTAR
-----	X_{L1m}	Maximum value expected for X_{ML} (used to estimate scale factors, X_{L1M} = 20,000 FT)

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
-----	k_p	Maximum analog voltage (k_p = 100v)
A2	-----	Smallest bit ADC resolution in feet

VII. SUBROUTINE MISCOM

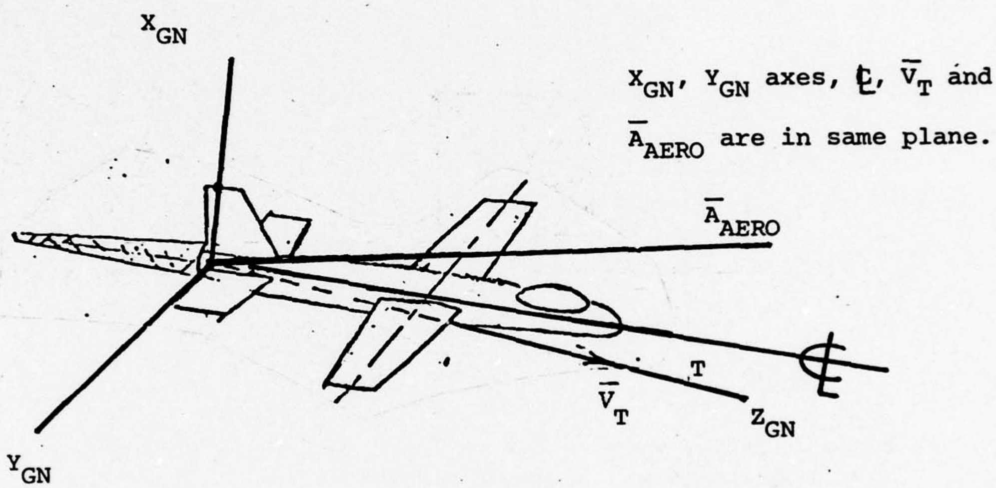
VII. SUBROUTINE MISCOM

Subroutine MISCOM transforms the relative missile minus target location in launch coordinates to target fixed coordinates referenced to the target tailpipe. The missile path projection is then computed by a least square straight line approximation of real time data. Nearest approach miss distance is computed in each plane of the target fixed coordinate system (referenced to tailpipe origin).



OVERVIEW OF SUBROUTINE MISCOM

FIGURE 7.1



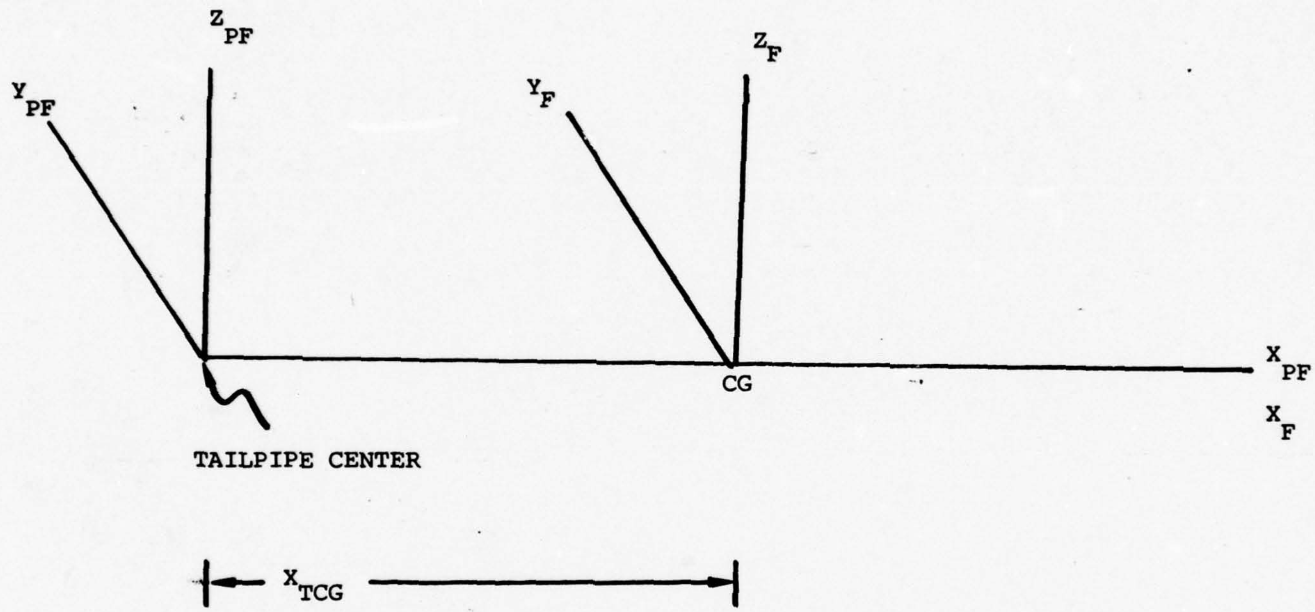
GENERALIZED TARGET COORDINATE SYSTEM
FIGURE 7.2

Transformation of Generalized Target Coordinates to Tailpipe Fixed Coordinates

$$\begin{bmatrix} X_{PF} \\ Y_{PF} \\ Z_{PF} \end{bmatrix} = \begin{bmatrix} \sin\alpha_T & 0 & \cos\alpha_T \\ 0 & -1 & 0 \\ \cos\alpha_T & 0 & -\sin\alpha_T \end{bmatrix} \begin{bmatrix} X_{GN} \\ Y_{GN} \\ Z_{GN} \end{bmatrix}$$

Transformation of Tailpipe Fixed Coordinates to Origin at Target CG

$$\begin{bmatrix} X_F \\ Y_F \\ Z_F \end{bmatrix} = \begin{bmatrix} 1-\frac{X_{TCG}}{X_{PF}} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} X_{PF} \\ Y_{PF} \\ Z_{PF} \end{bmatrix}$$



TAILPIPE TARGET FIXED AND TARGET FIXED COORDINATE SYSTEM RELATIONSHIP

FIGURE 7.3

MISSILE PATH PROJECTION

The missile path projection is computed in target fixed coordinates referenced to the target tailpipe. This projection is based upon a linear curve fit of real time relative-position-data.

For a least squares approximate linear curve fit, the projection equations are

$$Y_F = a_1 X_F + b_1$$

$$Z_F = a_2 X_F + b_2$$

The least square approximate fit for a_1 and b_1 is obtained from the simultaneous solution of the following equations.

$$a_1 \sum_{i=1}^{n} X_{F_i}^2 + b_1 \sum_{i=1}^{n} X_{F_i} = \sum_{i=1}^{n} X_{F_i} Y_{F_i}$$

$$a_1 \sum_{i=1}^{n} X_{F_i} + b_1 n = \sum_{i=1}^{n} Y_{F_i}$$

Then, a_2 and b_2 can be solved similarly

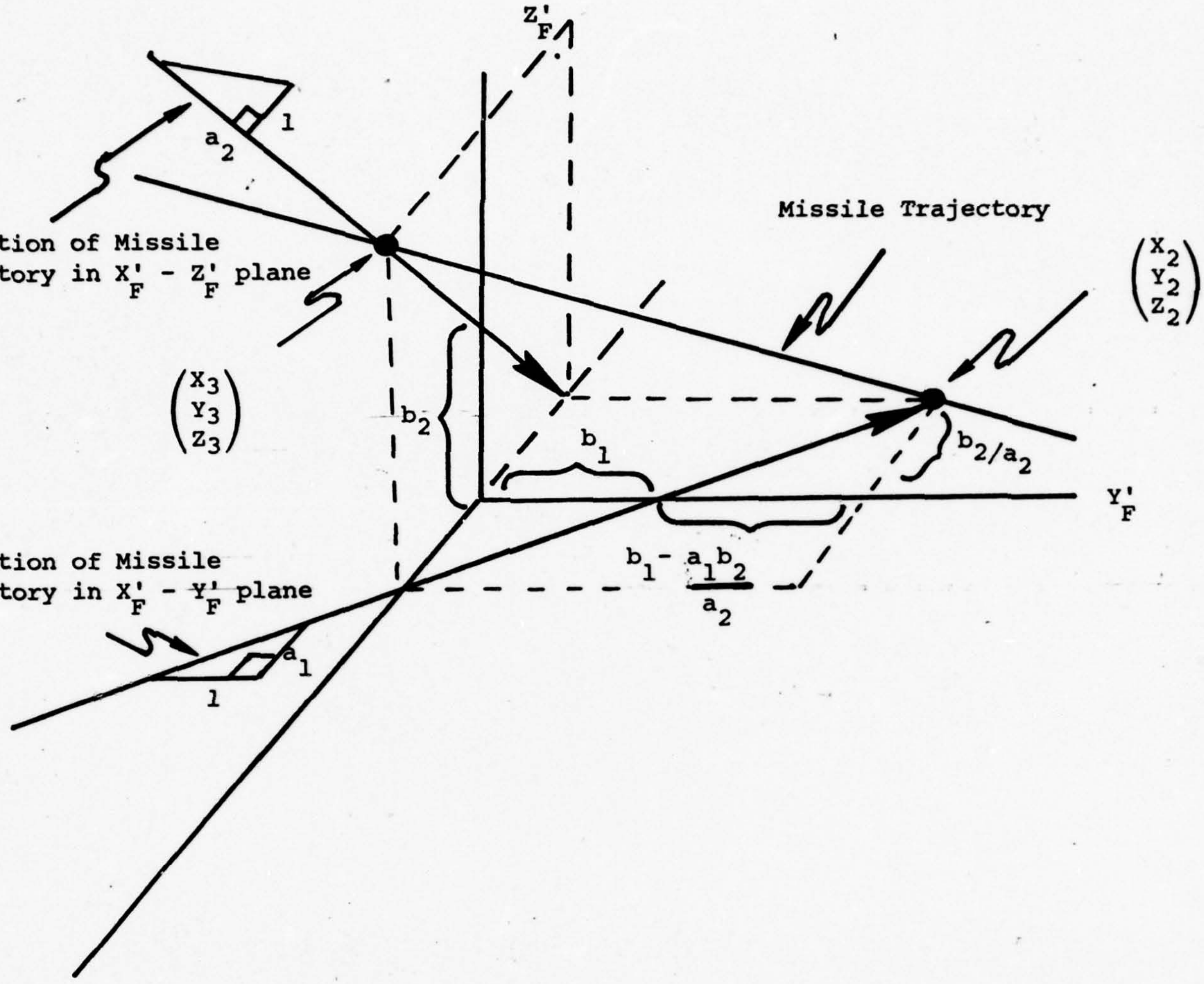
$$a_2 \sum_{i=1}^{n} X_{F_i}^2 + b_2 \sum_{i=1}^{n} X_{F_i} = \sum_{i=1}^{n} X_{F_i} Z_{F_i}$$

$$a_2 \sum_{i=1}^{n} X_{F_i} + b_2 n = \sum_{i=1}^{n} Z_{F_i}$$

where n is the number of real time data collection points.

Then, the piercing points of the missile trajectory into the $X_F' - Y_F'$ plane, $X_F' - Z_F'$ plane and the $Y_F' - Z_F'$ plane is computed. These values are printed as:

XM(1), YM(1), ZM(1) - the piercing point in the $Y_F' - Z_F'$ plane



Projections of Missile Trajectory onto $X_F' - Y_F'$ plane and $X_F' - Z_F'$ plane

FIGURE 7.4

XM(2),YM(2), ZM(2) - the piercing point in the $X_F' - Y_F'$ plane, and

XM(3), YM(3), ZM(3) - the piercing point in the $X_F' - Z_F'$ plane

The above piercing point are deduced from geometry as

$$\begin{bmatrix} X_{F1}' \\ Y_{F1}' \\ Z_{F1}' \end{bmatrix} = \begin{bmatrix} 0 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} XM(1) \\ YM(1) \\ ZM(1) \end{bmatrix}$$

$$\begin{bmatrix} X_{F2}' \\ Y_{F2}' \\ Z_{F2}' \end{bmatrix} = \begin{bmatrix} -b_2/a_2 \\ b_1 - \dfrac{a_1 b_2}{a_2} \\ 0 \end{bmatrix} = \begin{bmatrix} XM(2) \\ YM(2) \\ ZM(2) \end{bmatrix}$$

$$\begin{bmatrix} X_{F3}' \\ Y_{F3}' \\ Z_{F3}' \end{bmatrix} = \begin{bmatrix} -b\ /a \\ 0 \\ b_2 - \dfrac{a_2 b_1}{a_1} \end{bmatrix} = \begin{bmatrix} XM(3) \\ YM(3) \\ ZM(3) \end{bmatrix}$$

Then, the nearest approach of the missile trajectory to origin is computed in the $Y_F' - Z_F'$ plane, $X_F - Y_F$ plane and the $X_F - Z_F$ plane respectively as:

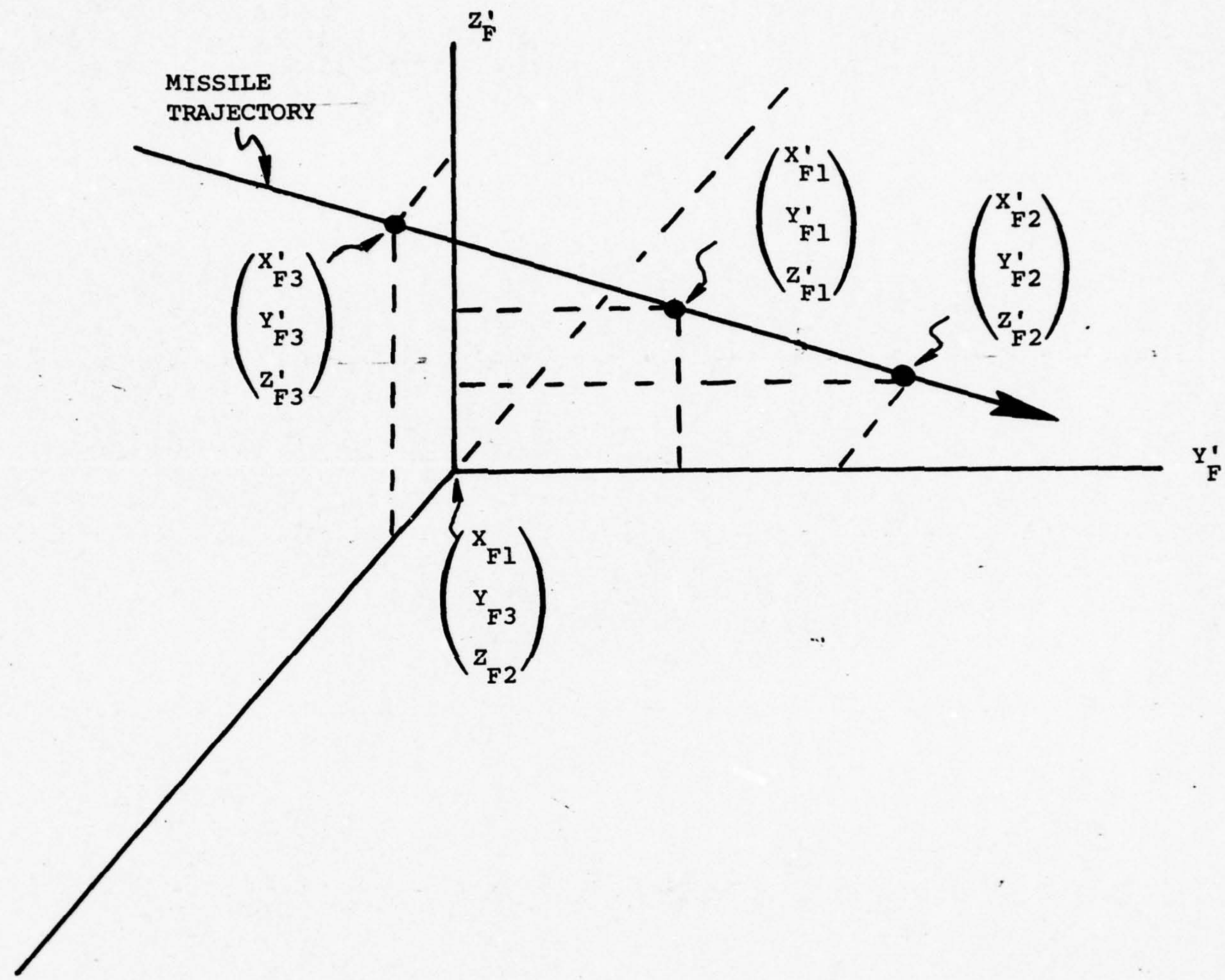
$$RM(1) - \sqrt{X_{F1}'^2 + Y_{F1}'^2 + Z_{F1}'^2}$$

$$RM(2) = \sqrt{X_{F2}'^2 + Y_{F2}'^2 + Z_{F2}'^2}$$

$$RM(3) = \sqrt{X_{F3}'^2 + Y_{F3}'^2 + Z_{F3}'^2}$$

Here the origin of the $X_F' - Y_F' - Z_F'$ system is

$$\begin{bmatrix} X_{F1}' \\ Y_{F3}' \\ Z_{F2}' \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$



ISOMETRIC PROJECTION OF MISSILE TRAJECTORY PIERCING POINTS IN TARGET FIXED COORDINATES

FIGURE 7.5

TABLE 7.1 DESCRIPTION OF VARIABLES IN SUBROUTINE MISCOM

COMPUTER VARIABLE	PHYSICAL VARIABLE	DESCRIPTION
FXA FYA FZA		Elements of the matrix transformation from launch coordinates to generalized target coordinates
FXB FYB FZB		
FXC FYC FZC		
DX DY DZ	$X_{ML} - X_{TL}$ $Y_{ML} - Y_{TL}$ $Z_{ML} - Z_{TL}$	Data collected during real time range table search (see PPX(I) PPY(I) and PPZ(I) in Subroutine REALT)
XT YT ZT	$X_{MGN} - X_{TGN}$ $Y_{MGN} - Y_{TGN}$ $Z_{MGN} - Z_{TGN}$	
AAA	a_s	Speed of sound in air
ZZZ	h_{asl}	Target altitude in earth fixed coordinate + altitude of launch site above sea level
VT	V_T	Velocity of target
XDEF YDEF ZDEF	X_{TE} Y_{TE} Z_{TE}	Target maneuver velocity at time of first real time data collection point
QM	Q_m	Mach number of target
CLA	$C_{L_{\alpha_T}}$	Aerodynamic lift coefficient of target due to angle of attack
WT	W_T	Weight of target
ST	S_T	Reference surface area of target
AT	α_T	Angle of attack of target
XS YS ZS	$X_{MGN} - X_{TGN}$ $Y_{MGN} - Y_{TGN}$ $Z_{MGN} - Z_{TGN}$	The last real time data point collected, expressed in generalized launch coordinates
	X_{TCG}	Distance from tailpipe center to CG measured along target centerline
	X_{PF}	

COMPUTER VARIABLE	PHYSICAL VARIABLE	DESCRIPTION
S2	$\cos(\theta_L)\cos(\psi_L)$	Elements of coordinate transformation launch coordinates to earth fixed coordinates
SPL		
S3	$\sin(\theta_L)\cos(\psi_L)$	
S4	$\cos(\theta_L)\sin(\psi_L)$	
CPL	$\cos(\psi_L)$	
S5	$\sin(\theta_L)\sin(\psi_L)$	
STL	$\sin(\theta_L)$	
CTL	$\cos(\theta_L)$	
N	---------	The number of data points collected during real time data collection
VVVV	$V_T(0)$	Speed of target at time = 0
XM(1),YM(1), ZM(1)	X'_{F1},Y'_{F1},Z'_{F1}	Missile trajectory piercing point in $Y'_F - Z'_F$ plane
XM(2),YM(2), ZM(2)	X'_{F2},Y'_{F2},Z'_{F2}	Missile trajectory piercing point in $X'_F - Y'_F$ plane
XM(3),YM(3) ZM(3)	X'_{F3},Y'_{F3},Z'_{F3}	Missile trajectory piercing point in $X'_F - Z'_F$ plane
RM(1),RM(2), RM(3)	---------	Distance of each piercing point from origin of $X'_F - Y'_F - Z'_F$ system
YA	a_1	See equations
ZA	a_2	See equations

VIII. SUBROUTINE GUID

VIII. SUBROUTINE GUID

(Coordinate transformation from earth fixed to launch coordinates)

$$\begin{bmatrix} X_L \\ Y_L \\ Z_L \end{bmatrix} = \begin{bmatrix} \cos\theta_L \cos\psi_L & \cos\theta_L \sin\psi_L & -\sin\theta_L \\ -\sin\psi_L & \cos\psi_L & 0 \\ \sin\theta_L \cos\psi_L & \sin\theta_L \sin\psi_L & \cos\theta_L \end{bmatrix} \begin{bmatrix} X_E \\ Y_E \\ Z_E \end{bmatrix}$$

TABLE 8.1 DESCRIPTION OF SYMBOLS FOR SUBROUTINE GUID

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
XD	------	Components in earth fixed coordinate system
YD	------	
ZD	------	
XDTG	------	Components in launch coordinate system
YDTG	------	
ZDTG	------	
COSSO	------	+ $\cos\theta_L$
COSSCO	------	+ $\cos\psi_L$
SINSCO	------	+ $\sin\psi_L$
SINSO	------	+ $\sin\theta_L$

IX. SUBROUTINE INIT

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IX. SUBROUTINE INIT

This subroutine computes the range table for real-time data collection and the initial conditions for the analog computer. More detail concerning the equations, given here, can be obtained in the section dealing with real-time digital computation.

Initial Velocity of Target in Launch Coordinate System

$$\begin{bmatrix} \dot{X}_{TL}(0) \\ \dot{Y}_{TL}(0) \\ \dot{Z}_{TL}(0) \end{bmatrix} \begin{bmatrix} \cos\theta_L \cos\psi_L & \cos\theta_L \sin\psi_L & -\sin\theta_L \\ -\sin\psi_L & \cos\psi_L & 0 \\ \sin\theta_L \cos\psi_L & \sin\theta_L \sin\psi_L & \cos\theta_L \end{bmatrix} \begin{bmatrix} \dot{X}_{TE}(0) \\ \dot{Y}_{TE}(0) \\ \dot{Z}_{TE}(0) \end{bmatrix}$$

where $\theta_L = \theta_L(0)$

$\psi_L = \psi_L(0)$

This transformation is performed in SUBROUTINE GUID

NOTE: The transformation is orthonormal therefore $A^{-1} = A^T$

Dive Angle

$$SEO = \tan^{-1} \frac{\dot{Z}_{TE}(0)}{\sqrt{\dot{X}^2_{TE}(0) + \dot{Y}^2_{TE}(0)}} \quad , \text{ if } \dot{Y}_{TE}(0) \neq 0$$

NOTE: For all other cases see computations performed in program MAIN

Initial Angle of Attack

$a = 1116.89 + .003894\ h_{asL}$ (SLUGS/FT³)

$\rho = .00237692\ e^{.00003h_{asL}}$ (FT/SEC)

$Q_m = V_T/a_s$

$$C_{L_{\alpha_T}} = CLAA\Big|_{Q_m}$$

$$\alpha = \frac{2W_T}{\rho V_T^2 \, C_{L_{\alpha_T}} \, S_{T_g}} \qquad \sqrt{\ddot{X}_{TE}^2(0) + \ddot{Y}_{TE}^2(0) + \ddot{Z}_{TE}^2(0)}$$

Initial $\cos(\varepsilon)$

$$\cos(\varepsilon) = \{(\sin\theta_L)(\dot{Z}_{TE}(0)\cos\alpha - \sqrt{\dot{X}_{TE}^2(0) + \dot{Y}_{TE}^2(0)}\ \sin\alpha)$$

$$- (\cos\alpha + \dot{Z}_{TE}(0)\sin\alpha / \sqrt{\dot{X}_{TE}(0) + \dot{Y}_{TE}(0)}) \quad \cdot$$

$$(\dot{X}_{TE}(0)\cos\theta_L \cos\psi_L + \dot{Y}_{TE}(0)\cos\theta_L \sin\psi_L)\}/V_T$$

Initial Apparent Plume Length to Breadth Ratio

$$\ell/B = (L/B)\sqrt{1 - \cos^2(\varepsilon)}$$

Initial $\overline{L}_{os}$

$$L_x = -R_i \cos\theta_L \cos\psi_L$$

$$L_y = -R_i \cos\theta_L \sin\psi_L$$

$$L_z = R \sin\theta_L$$

Initial Horizon Reference Vector

$$\beta = \cos^{-1} \frac{L_y}{\sqrt{L_x^2 + L_y^2}}$$

$$C_x = -\cos(\beta)$$

$$C_y = \begin{cases} -\sin(\beta), & \text{if } X_{Los} < 0 \\ +\sin(\beta), & \text{if } X_{Los} \geq 0 \end{cases}$$

Initial Target Centerline Vector

$$C_{L_x} = \frac{\dot{X}_{TE}(0)\ (\cos\alpha + \dot{Z}_{TE}(0)\ \sin\alpha)}{\sqrt{\dot{X}^2_{TE}(0) + \dot{Y}^2_{TE}(0)}}$$

$$C_{L_y} = \frac{\dot{Y}_{TE}(0)\ (\cos\alpha + \dot{Z}_{TE}(0)\ \sin\alpha)}{\sqrt{\dot{X}^2_{TE}(0) + \dot{Y}^2_{TE}(0)}}$$

$$C_{L_z} = \dot{Z}_{TE}(0)\ \cos\alpha - \frac{\sqrt{\dot{X}^2_{TE}(0) + \dot{Y}^2_{TE}(0)}}{V_T}\ \sin\alpha$$

Initial Plume Rotation Angle

$$\theta = \cos^{-1} \frac{C_x\ (L_y C_{Lz} - L_z C_y) + C_y (L_z C_x - L_x C_z)}{\sqrt{(L_y C_{Lz} - L_z C_{Ly})^2 + (L_z C_{Lx} - L_x C_{Lz})^2 + (L_x C_{Ly} - L_Y C_{Lx})^2}}$$

$$D_z = L_x C_{Ly} - L_y C_{Lx}$$

$$T_{rp} = \pi/2 - \theta \text{ , if } D_z < 0$$

$$\pi/2 + \theta \text{ , if } D_z > 0 \text{ and } \theta < \pi/2$$

$$\theta - 3\pi/2, \quad \text{if } D_z > 0 \text{ and } \theta > \pi/2$$

<u>Initial Plume Iris Ratio</u>

$$H_{c7} = 1209.675 \; H\Big|_{\substack{R=7000 \\ \varepsilon}} e^{-2.341(\ln(R_i/22965.831))} \qquad (\text{w/cm}^2)$$

$$P_1 = 2\tan^{-1}\left(\frac{B/2}{\ell}\right) \qquad (\text{DEG})$$

$$P = \frac{(f)\;(\ell)}{|\overline{L}_{os}|} \qquad (\text{IN})$$

$$A_{t7} = \frac{P_2^2 \sin (P_1)}{2\cos^2(P_1/2)} \qquad (\text{IN})^2$$

$$J_{tu7} = e^{1.003258(\ln A_{t7}/10)} \qquad (\text{W/STER})$$

$$I_{r7} = \frac{\dfrac{H_{c7}}{T_{fplume}}}{J_{tu}}$$

$$i_7 = i_7(I_{r7}) \qquad (\text{table look up})$$

TABLE 9.1 DESCRIPTION OF SYMBOLS FOR SUBROUTINE INIT

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
NPTS	-----	Number of real-time data collection points
XTERM	-----	Distance between target and missile at last data collection point
DX	-----	Distance between real-time data collection points
GGG	γ_{min}	Minima of the overload function (see SUBROUTINE KSCALE)
DIF	-----	The difference between the data collection distance commanded and the largest data collection distance possible with the analog scaling given.
NADJ	-----	New value for NPTS if NPTS is too large
XD,XDX	$\dot{X}_{TE}(0)$	
YD,YDY	$\dot{Y}_{TE}(0)$	Target initial velocity in earth coordinates
ZD,ZDZ	$\dot{Z}_{TE}(0)$	
XDTG	$\dot{X}_{TL}(0)$	
YDTG	$\dot{Y}_{TL}(0)$	Target initial velocity in launch coordinates
ZDTG	$\dot{Z}_{TL}(0)$	
KKK	-----	KKK = 0 if $\dot{Y}_{TE}(0) \neq 0$ 1 if $\dot{Y}_{TE}(0) = 0$
SEO	-----	Dive angle (Note, some cases are computed in MAIN)

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
XDTGM(I)	$\dot{X}_{TL}$	Target velocity tables in launch coordinates
YDTGM(I)	$\dot{Y}_{TL}$	
ZDTGM(I)	$\dot{Z}_{TL}$	
IS1	-----	Print flag, IS1 $\neq$ 1 indicates print desired
AAA	a_s	Speed of sound
ZZZ	$h_{a_{sL}}$	Specific target altitude in earth fixed coordinates + altitude of missile launch site above sea level (FT)
PHO	ρ	Air density (SLUGS/FT^3)
QM	Q_m	Mach number of target
VVVV	V_T	Velocity of target (Computed in MAIN)
CLA	$C_{L_{\alpha_T}}$	Aerodynamic lift coefficient of target due to angle of attack
CLAA	-----	Table containing CLA as a function of mach number
WT	W_T	Weight of target
ST	S_T	Reference surface area of target
XEU	$\ddot{X}_{TE}(0)$	Initial acceleration of target in earth fixed coordinates
YEU	$\ddot{Y}_{TE}(0)$	
ZEU	$\ddot{Z}_{TE}(0)$	
AT	α	Initial target angle of attack
STL	-----	$\sin(\theta_L)$

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
C1	-----	$\cos(\alpha)$
S9	-----	$\sqrt{X_{TE}^2(0) + Y_{TE}^2(0)}$
S1	-----	$\sin(\alpha)$
S2	-----	$\cos(\theta_L) \cos(\psi_L)$
S4	-----	$\cos(\theta_L) \sin(\psi_L)$
RLB	ℓ/B	Apparent ratio of plume length to breadth
RLBK	L/B	Actual ratio of plume length to breadth
XLOS	L_x	
YLOS	L_y	Initial components of $\bar{L}_{os}$ in earth fixed coordinates
ZLOS	L_z	
R	R_i	Initial range of target (FT)
BET	β	$\cos^{-1}(L_y/\sqrt{L_x^2 + L_y^2})$
L_x	L_x	Components of Horizon Reference vector in earth fixed coordinates
L_y	L_y	
CLX	C_{L_x}	
CLY	C_{L_y}	Components of target center line vector in earth fixed coordinates
CLZ	C_{L_z}	
TRP	T_{rp}	Initial plume rotation angle

PROGRAM VARIABLE	SYMBOL	DESCRIPTION
THE	θ	-------------------------------
HC7FT	H_{c7}	Commanded irradiance for plume
P1IRSS	P_1	Vertex angle of plume transparency (DEG)
P2IRSS	P_2	Length of plume transparency (IN)
AT7	A_{t7}	Area of plume transparency
RN	i_7	Iris ratio number 7
----------	f	Focal length of projection lens
----------	ℓ	Apparent length of plume

APPENDIX A. STINGER CODE

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APPENDIX A

This Appendix contains a proposed, structured version of the MICOM Hybrid STINGER program. Usage would require the following changes:

1. Under "Manual Selection of Launch Conditions" where the variables KA, ITT, TAU, IRSS are read from a card - the program should be altered to read these variables from the terminal.

2. In order to integrate the new FLIGHT and REALT programs into the structured STINGER package, a few changes in the common blocks and variables in FLIGHT and REALT will be necessary.

3. In the structured version of STINGER only the programs MAIN and INIT have been essentially altered. Some cleaning up and alteration may be necessary in the subroutines which perform the post real-time calculations.

4. There are now two interpolation routines - INTERP and LINTRP. LINTRP is much faster and INTERP should probably be removed unless higher order interpolation than linear is desired.

INPUTS TO STRUCTURED STINGER PROGRAM

IS1 PRINT FLAG
IS1 = 0 for limited printout
IS1 = 1 for full printout
format I5

NRUNS DESIRED NUMBER OF RUNS PER FLIGHT CONDITION
1 NRUNS 20
format I5

NPTS, DX, XTERM
NPTS = NUMBER OF DATA POINTS TO BE COLLECTED
1 NPTS 50

DX = DELTA RANGE BETWEEN COLLECTED DATA POINTS

XTERM = X SEPARATION AT WHICH REAL TIME IS TERMINATED
format I10, 2F10.0

NL NUMBER OF SETS OF LAUNCH CONDITIONS
1 NL 61
format I5

(ZTEO(I), ASC(I), RR(I), I = 1, NL)

THESE ARE THE NL SETS OF LAUNCH CONDITIONS

ZTEO(I) IS THE I-TH INITIAL ALTITUDE

ASC(I) IS THE I-TH CROSSING ANGLE

RR(I) IS THE I-TH INITIAL RANGE
format 3F10.2

III LAUNCH SELECTION FLAG
III = 0 for manual selection
III = 1 for automatic selection
format I5

NOTE: FROM THIS POINT ON, THE INPUTS TO BE SUPPLIED DEPEND ON THE VALUE OF III CHOSEN ABOVE.

THE FOLLOWING INPUTS ARE READ ONLY IF III = 0 (MANUAL SELECTION) OR AFTER A FULL SET OF AUTOMATIC RUNS IS COMPLETED.

KA, ITT, TAU, IRSS

KA = NUMBER OF LAUNCH SET TO BE USED
ITT = NUMBER OF TARGET TRAJECTORY TO BE USED
TAU = TIME POINT ON THE TARGET TRAJECTORY AT WHICH THE MISSILE IS LAUNCHED
IRSS IS THE IRSS FLAG
IRSS = 0 NOT AN IRSS RUN
IRSS = 1, IRSS RUN
format 2I5, F5.1, I5

AFTER A MANUAL RUN IS COMPLETED, THE PROGRAM WILL CYCLE AND READ NEW VALUES OF KA, ITT, TAU, IRSS

THERE ARE TWO SPECIAL CONVENTIONS ON KA.

KA negative - restart program at very beginning
KA > 61 - terminate program

THE FOLLOWING INPUTS ARE READ ONLY IF III = 1 (AUTOMATIC SELECTION)

NSAM QUALITY CONTROL TEST CASE SAMPLE SIZE

$2 \leq NSAM \leq 11$
format I5

ICON CONTINUATION FLAG

ICON = 1 continue after quality control failure
ICON = 2 rerun previous runs after quality control failure
format I5

INL INITIAL LAUNCH SET NUMBER
$1 \leq INL \leq NL$
format I5

(CLMS(1), CLS1(I), CLS2(I), I = 1, 10)

DATA FOR COMPUTING CONTROL LIMITS
format 3 F6.3

Q1, Q2, Q3, Q4, Q5, Q6

DATA FOR COMPUTING CONTROL LIMITS
format 6F10.4

W1, W2, W3, W4, W5, W6

DATA FOR COMPUTING CONTROL LIMITS
format 6F10.4

VARIABLE REFERENCE LIST

VARIABLE	COMMON BLOCK	USE
AAA		Speed of sound
AARUNS		Averages related to kill probabilities
AASUM		
ABRUNS		
ABSUM		
ADSF(10)	COMM	Array of analog-to-digital scale factors
ARB(20)		Array for storing miss distances relative to tailpipe
ARBT(20)		Array for storing miss distances relative to CG
ARC(20)		See ARB
ARCT(20)		See ARBT
ARM(20)		See ARB
ARMT(20)		See ARBT
AS	EXTRA	Target crossing angle
ASC(61)		Table of target crossing angles
ASEO		Target dive angle (degrees)
AT	GTARG	Initial target angle of attack
AXB(20)		See ARB
AXBT(20)		See ARBT
AXC(20)		See ARB
AXCT(20)		See ARBT
AXM(20)		See ARB
AXMT(20)		See ARBT
AYB(20)		See ARB
AYBT(20)		See ARBT
AYC(20)		See ARB
AYCT(20)		See ARBT
AYM(20)		See ARB
AYMT(20)		See ARBT
AZB(20)		See ARB
AZBT(20)		See ARBT
AZC(20)		See ARB
AZCT(20)		See ARBT
AZM(20)		See ARB
AZMT(20)		See ARBT
A1		Target angle of attack (RADIANS)
A1P1	COMP	Control limits
A1P2	COMP	
A1P3	COMP	
A1P4	COMP	

VARIABLE REFERENCE LIST (Con't)

VARIABLE	COMMON BLOCK	USE
A1P5	COMP	Control limits
A1P6	COMP	
A2P1	COMP	
A2P2	COMP	
A2P3	COMP	
A2P4	COMP	
A2P5	COMP	
A2P6	COMP	
BDHX(22)	PK	Tables related to lethality
BDHY(22)	PK	
BDHZ(22)	PK	
CA		Cosine of target angle of attack
CLA		Target lift coefficient
CLAA(10)	RTCOM	Target lift coefficient table (function of mach)
CLMS(10)	COMP	Data for calculating control limits
CLS1(10)	COMP	
CLS2(10)	COMP	
CLX		Components of initial target center line vector
CLY		
CLZ		
COSE		Cosine of the angle between the line of sight and the target center line
COSEI	RTCOM	Initial value of cose
COSMU1	MU	Terms of a transformation matrix (see subroutine PRIME)
COSMU2	MU	
COSMU3	MU	
COSSCO	ANG	Cosine of PSILR
COSSO	ANG	Cosine of THETLR
CPL	RTCOM	= COSSCO
CTL	RTCOM	= COSSO
CX		Components of initial horizon reference vector
CY		
C1		Cosine of AT
DAOUT1	*DAC1	Variables which are converted from digital to analog
DAOUT2	*DAC1	
DAOUT3	*DAC1	
DAOUT4	*DAC1	
DAOUT5	*DAC1	
DAOUT6	*DAC1	

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
DAOUT7	*DAC1	
DAOUT8	*DAC1	Variables which are converted from digital to analog
DAOUT9	*DAC1	
DAOUT10	*DAC1	
DAOUT11	*DAC1	
DASF(11)	COMM	Array of digital to analog scale factors
DELTAR(30)	MISL	Target range table (function of time)
DT		Current time in real time
DTF	RTCOM	Value of DT at termination of real time
DTR		Conversion factor-degrees to RADIANS
DX	EXTRA	Delta range between collected data points
DX		X separation between target and missile
DXG	RTCOM	Value of DX at termination of real time
DY		Y separation between target and missile
DYG	RTCOM	Value of DY at termination of real time
DZ		Z separation between target and missile
DZG	RTCOM	Value of DZ at termination of real time
ECOS(17)	RTCOM	Table used in calculating IRIS ratio 7
EDOT	RTCOM	GGG/G
FCI77(9)	RTCOM	Table used in calculating IRIS ratio 7
FI7T(9)	RTCOM	Table used in calculating IRIS ratio 7
FXA	GTARG	
FXB	GTARG	
FXC	GTARG	
FYA	GTARG	Terms of a transformation matrix (see subroutine MISCOM)
FYB	GTARG	
FYC	GTARG	
FZA	GTARG	
FZB	GTARG	
FZC	GTARG	
G	RTCOM	Estimated time at 1000 feet to go
GGG	RTCOM	Parameter used in variable analog scale factor
HR7EE(17)	RTCOM	Table used in calculating IRIS ratio 7
IADIN1	*ADC1	
IADIN2	*ADC1	
IADIN3	*ADC1	Values resulting from analog to digital conversion
IADIN4	*ADC1	
IADIN5	*ADC1	
IADIN6	*ADC1	

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
IADIN7	*ADC1	Values resulting from analog to digital conversion
IADIN8	*ADC1	
IADIN9	*ADC1	
IADIN10	*ADC1	
ICN	MISD	Number of the current real time run (1 ICN NR)
ICON		Flag to indicate continuation after quality control failure
IERR		Error flag for equipment reservation
IFT	COMP	Flag for quality control failure
III	MANEUV	Flag to indicate manual or automatic launch selection
IIN	*IDIS2	Input discrete word
INFLRT	COMM	Flag to indicate first pass through real time code
INL		Launch set number (automatic selection)
IOUT	*ODIS2	Output discrete word
IPASS		Flag to indicate first pass through main program
IPLANE	COMP	Parameter used in quality control test
IPTS	RTCOM	Number of data points to be collected before intercept
IQC1		Flag to indicate first launch set (automatic sel.)
IRSS		Flag to indicate IRSS run
IS1	PRNT	Flag to indicate full or partial printout
ITAU(60)	MANEUV	Table of launch times (see TAU)
ITRAJ(60)	MANEUV	Table of target trajectory numbers
ITT	MANEUV	Number of current target trajectory
I88		Flag to indicate last launch set (automatic selection)
I99	COMP	Flag to indicate test case is due
KA		Number of current launch conditions
KILL(22)	PK	Table related to lethality
LEVEL	RTCOM	Flag to indicate target maneuver in progress
LOOP1	COMM	Counters for the two loops in the real time code
LOOP2	COMM	
LTMAX	COMM	Maximum execution time of real time loop
NADJ	MANEUV	Number of entries in range table (see XXS)
NERR		Error flag for subroutine INTERP
NL		Number of sets of launch conditions

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
NPATH	COMM	Flag to indicate which loop to execute in real time code
NPTS	EXTRA	Desired number of data points
NPX		Number of data points used in interpolation (NPX = 2 is linear interpolation)
NR		Number of flights to be performed in current run
NRUNS		Desired number of runs per flight condition
NSAM	COMP	Quality control test case sample size (2 NSAM 11)
NT	RTCOM	Number of points in target trajectory tables
NX		Argument for subroutine interp-number of points in tables
PH0		Air density
PI		3.14159265
PIO2		PI/2.
PPX(50)	RTCOM	Arrays for storing DX, DY, and DZ
PPY(50)	RTCOM	respectively at points corresponding
PPZ(50)	RTCOM	to range table entries (see XXS)
PSIL		PSI launch-one of the two euler angles in the transformation from earth to launch coordinate system (degrees)
PSILR		PSIL converted to RADIANS
QM		Target mach number
QMM(10)	RTCOM	Table of mach numbers (goes with CLAA(10))
Q1	COMP	
Q2	COMP	
Q3	COMP	Data for calculating control limits
Q4	COMP	
Q5	COMP	
Q6	COMP	
RI	RTCOM	Initial range-missile to target
RLB		Apparent plume length to breadth ratio
RLBI	RTCOM	Initial value of RLB
RLBK	RTCOM	Actual plume length to breadth ratio
RM(3)	MISD	MISS distance array
RN		IRIS ratio 7
RNI	RTCOM	Initial value of RN

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
RR(61)		Table of target initial ranges
RTD		Conversion factor-radians to degrees
SA		Sine of target angle of attack
SEO		Target dive angle (RADIANS)
SINMU1	MU	Terms of a transformation matrix (see subroutine PRIME)
SINMU2	MU	
SINMU3	MU	
SINSCO	ANG	Sine of PSILR
SINSO	ANG	Sine of THETLR
SL0		Sense line zero
SL5		Sense line five
SL6		Sense line six
SL15		Sense line fifteen
SPHG	PK	Variables related to kill probabilities
SPHS	PK	
SPK	PK	
SPL	RTCOM	= SINSCO
SPM	PK	See SPHG
SPO		Plume rotation angle
SPOI	RTCOM	Initial value of SPO
STL	RTCOM	= SINSO
S1		Sine of AT
S1P1	COMP	Control limits
S1P2	COMP	
S1P3	COMP	
S1P4	COMP	
S1P5	COMP	
S1P6	COMP	
S2	RTCOM	Term of earth-to-launch transformation matrix
S2P1	COMP	Control limits
S2P2	COMP	
S2P3	COMP	
S2P4	COMP	
S2P5	COMP	
S2P6	COMP	
S3	RTCOM	See S2
S4	RTCOM	
S5	RTCOM	

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
TAMA(30)	MISL	Table of times-goes with DELTAR (30) and VM (30)
TAU		Time point on target trajectory at which missile is launched
THETAL	RTCOM	THETA launch - see PSIL (degrees)
THETLR		THETAL converted to RADIANS
TIME(50)	RTCOM	Array for storing DT at points corresponding to range table entries (See XXS)
TM(30)		Table of times-goes with XDEM, YDEM, ZDEM
TMA(30)	RTCOM	Table of times-goes with XDM, YDM, ZDM
TRP		= SPO
VM(30)	MISL	Target velocity table (function of time)
VMX(50)	RTCOM	Arrays for storing XDOT, YDOT and ZDOT
VMY(50)	RTCOM	Respectively at points corresponding
VMZ(50)	RTCOM	To range table entries (see XXS)
VT	GTARG	Target velocity (in subroutine MISCOM)
VTI		Target velocity in real time
VVVV	EXTRA	Initial target velocity
W1	COMP	
W2	COMP	
W3	COMP	Data for calculating control limits
W4	COMP	
W5	COMP	
W6	COMP	
X		Initial target X corrdinate in earth system
XC		Target velocity X component-earth system
XCOMP		Target velocity X component-launch system
XD	COMB	Used in earth-to-launch transformation (subroutine GUID)
XDDE	COMB	Target acceleration over data collection range-X component
XDEF	COMB	Target velocity at first range table entry-X component
XDEM(30, 45)	MANEUV	Array of 45 target velocity tables in earth system-X components
XDH(22)	PK	Table related to lethality
XDM(30)	RTCOM	Current target velocity table in earth system-X component
XDO	RTCOM	Value of XDOT at termination of real time

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
XDOT		Target-missile relative velocity-X component
XDTG	COMB	See XD
XDTGMS(30)	RTCOM	Current target velocity table in launch system-X component
XDTGO	RTCOM	Target initial velocity in launch system-X component
XE(30)	RTCOM	Target acceleration table-X component
XLOS		Missile to target line of sight-X component
XM(3)	MISD	MISS distance array
XMAN(4, 50)	RTCOM	Array for storing DT, XCOMP, YCOMP, ZCOMP at range table entries
XMISS(7)	RTCOM	Array for storing DX, DY, DZ, XDOT, YDOT, ZDOT and XMISSC if missile misses target
XMISSC		Variable which indicates a miss
XTERM	EXTRA	X separation between missile and target at which real time is terminated
XXS(50)	RTCOM	Range table for data collection-NADJ points separated by DX and ending with XTERM
XXX		X separation between target and missile-comes from an analog value which is scaled ten times smaller than DX
Y		Initial target Y coordinate in earth system
YA	COMD	Related to MISS distance
YC		Target velocity Y component-earth system
YCOMP		Target velocity Y component-launch system
YD	COMB	See XD
YDDE	COMB	See XDDE-Y component
YDEF	COMB	See XDEF-Y component
YDEM(30, 45)	MANEUV	See XDEM-Y components
YDH(22)	PK	See XDH
YDM(30)	RTCOM	See XDM-Y component
YDO	RTCOM	Value of YDOT at termination of real time
YDOT		See XDOT-Y component
YDTG	COMB	See XD
YDTGMS(30)	RTCOM	See XDTGMS-Y component
YDTGO	RTCOM	See XDTGO-Y component
YE(30)	RTCOM	See XE-Y component

VARIABLE REFERENCE LIST (Con't.)

VARIABLE	COMMON BLOCK	USE
YLOS		See XLOS-Y component
YM(3)	MISD	MISS distance array
YYY		See XXX-Y component
Z		Initial target Z coordinate in earth system
ZA	COMD	See YA
ZABOVE		Altitude of launch site (negative)
ZALT	RTCOM	Target altitude (negative)
ZC		Target velocity Z component-earth system
ZCOMP		Target velocity Z component-launch system
ZD	COMB	See XD
ZDDE	COMB	See XDDE-Z component
ZDEF	COMB	See XDEF-Z component
ZDEM(30, 45)	MANEUV	See XDEM-Z component
ZDH(22)	PK	See XDH
ZDM(30)	RTCOM	See XDM-Z component
ZDO	RTCOM	Value of ZDOT at termination of real time
ZDOT		See XDOT-Z component
ZDTG	COMB	See XD
ZDTGMS(30)	RTCOM	See XDTGMS-Z component
ZDTGO	RTCOM	See XDTGO-Z component
ZE(30)	RTCOM	See XE-Z component
ZLOS		See XLOS-Z component
ZM(3)	MISD	MISS distance array
ZTEO(61)		Table of target initial altitudes
ZZZ		See XXX-Z component

COMMON BLOCK CROSS-REFERENCE TABLE

	ANG	COMB	COMD	COMM	COMP	EXTRA	GTARG	MANEUV	MISD	MISL	MU	PK	PRNT	RTCOM
MAIN	X		X		X	X		X	X			X	X	X
BLOCK DATA								X		X		X		X
FLIGHT				X										X
GUID	X	X												
HWFLOT														
INIT		X				X		X						X
INTERP														
KSCALE										X			X	X
LETH			X				X	X	X			X	X	X
LINTRP														
MEAN					X									
MISCOM		X	X			X	X	X	X		X		X	X
PRIME		X						X	X		X		X	X
QCLIM					X									
REALT				X										X

COMMON/ANG/

COSSCO

COSSO

SINSCO

SINSO

COMMON/COMB/

XD

XDDE

XDEF

XDTG

YD

YDDE

YDEF

YDTG

ZD

ZDDE

ZDEF

ZDTG

COMMON/COMD/

YA

ZA

COMMON/COMM/

ADSF (10)

DASF (11)

INFLRT

LOOP1

LOOP2

LTMAX

NPATH

COMMON/COMP/

A1P1
A1P2
A1P3
A1P4
A1P5
A1P6
A2P1
A2P2
A2P3
A2P4
A2P5
A2P6
CLMS (10)
CLS1(10)
CLS2(10)
IFT
IPLANE
I99
NSAM
Q1
Q2
Q3
Q4
Q5
Q6
S1P1
S1P2
S1P3
S1P4
S1P5
S1P6
S2P1
S2P2
S2P3
S2P4
S2P5
S2P6
W1
W2
W3
W4
W5
W6

COMMON/EXTRA/

AS

DX

NPTS

VVVV

XTERM

COMMON/GTARG/

AT

FXA

FXB

FXC

FYA

FYB

FYC

FZA

FZB

FZC

VT

COMMON/MANEUV/

III

ITAU(60)

ITRAJ(60)

ITT

NADJ

XDEM(30, 45)

YDEM(30, 45)

ZDEM(30, 45)

COMMON/MISD/

ICN

RM(3)

XM(3)

YM(3)

ZM(3)

COMMON/MISL/

DELTAR(30)

TAMA(30)

VM(30)

COMMON/MU/

COSMU1

COSMU2

COSMU3

SINMU1

SINMU2

SINMU3

COMMON/PK/

BDHX(22)

BDHY(22)

BDHZ(22)

KILL(22)

SPHG

SPHS

SPK

SPM

XDH(22)

YDH(22)

ZDH(22)

COMMON/PRNT/

IS1

COMMON/RTCOM/

CLAA(10)

COSEI

CPL

CTL

DTF

DXG

DYG

DZG

ECOS(17)

EDOT

FC177(9)

FI7T(9)

G

GGG

HR7EE(17)

IPTS

LEVEL

NT

PPX(50)

PPY(50)

PPZ(50)

RI

RLBI

RLBK

RNI

SPL

SPOI

STL

S2

S3

S4

S5

THETAL

TIME(50)

TMA(30)

VMX(50)

VMY(50)

VMZ(50)

XDM(30)

XDO

XDTGMS(30)

XDTGO

XE(30)

XMAN(4, 50)

XMISS(7)

COMMON/RTCOM/ (Con't)

XXS(50)

YDM(30)

YDO

YDTGMS(30)

YDTGO

YE(30)

ZALT

ZDM(30)

ZDO

ZDTGMS(30)

ZDTGO

ZE(30)

EXPLANATION OF FLOW DIAGRAMS

The flow diagrams included here are hierarchical in nature with a top-down structure. In the first-level flow diagram, the program is broken down into its major modules, numbered I., II., III., etc., and the relationships among these modules are shown.

Each module in the first-level diagram is analyzed in more detail in a second-level flow diagram. For example, module III. in the first-level diagram is broken down into submodules numbered III. A., III. B., III. C., etc.

Some of the second-level modules are broken down further in third-level diagrams. For example, module III. K. in the second-level diagram devoted to module III. is broken down in a third-level diagram into blocks numbered III. K. 1., III. K. 2., etc.

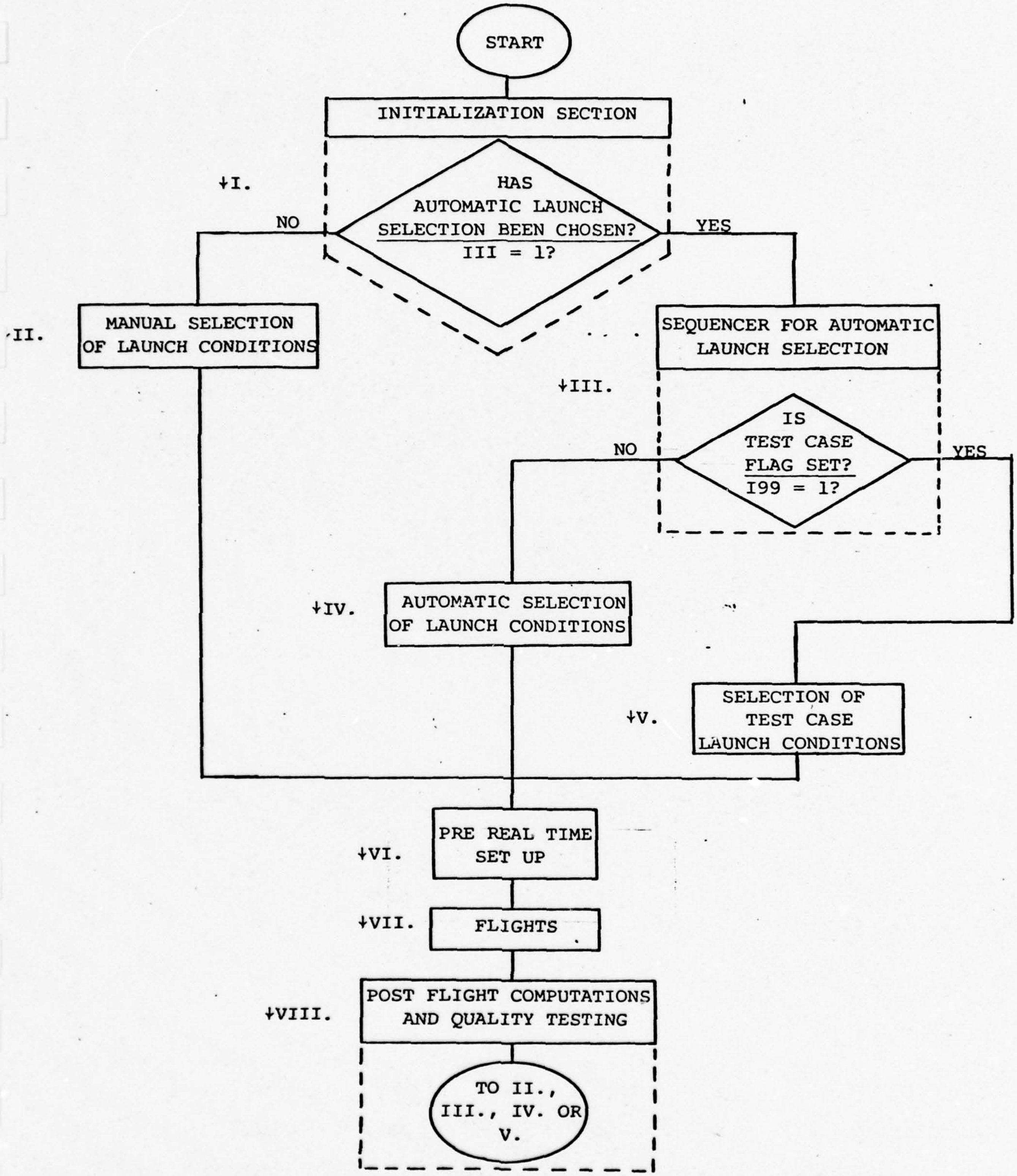
The symbol ↓ appearing before a block number indicates that there is a lower-level diagram devoted to that block.

MAIN PROGRAM

STINGER HYBRID SIMULATION

FIRST-LEVEL FLOW DIAGRAM

MAIN PROGRAM
STINGER HYBRID SIMULATION



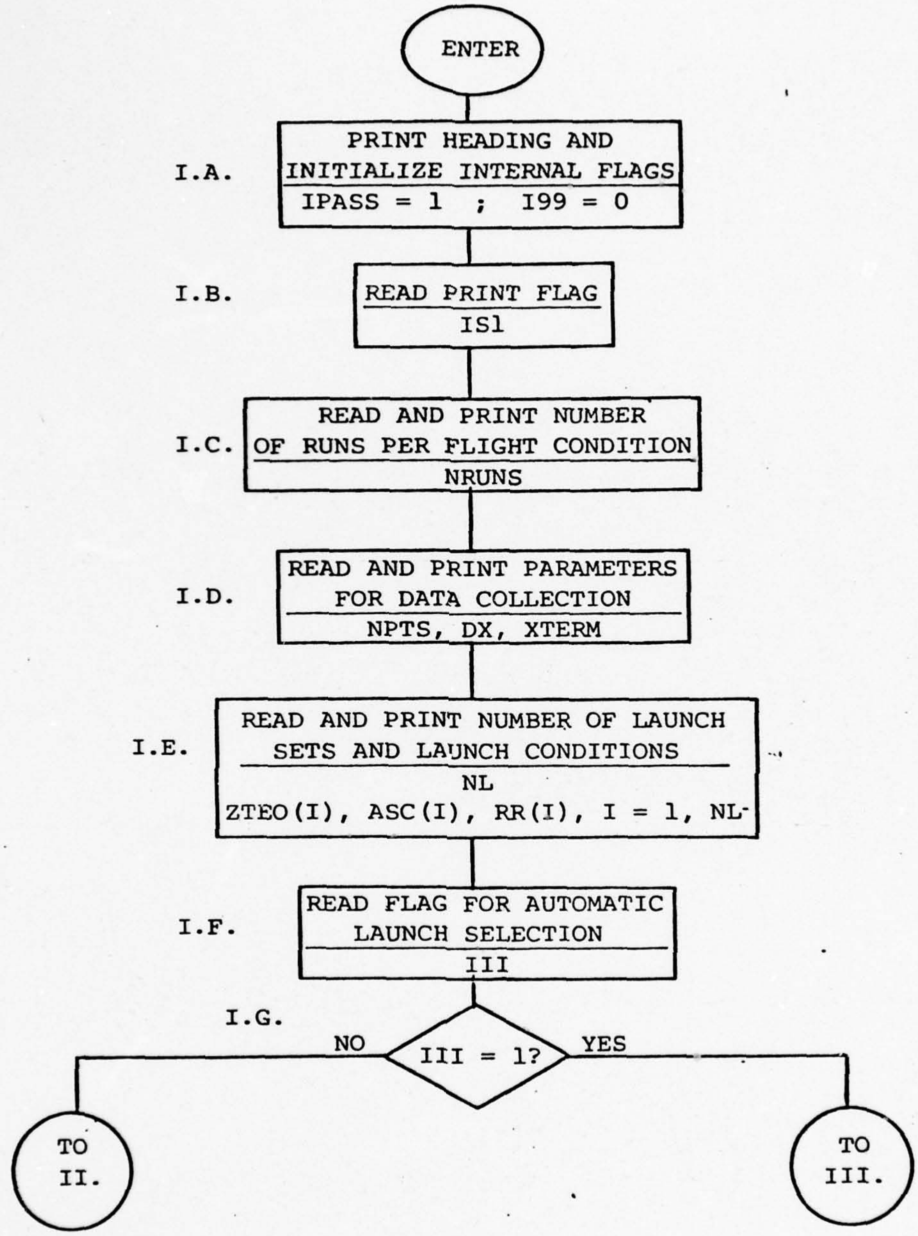
MAIN PROGRAM

STINGER HYBRID SIMULATION

SECOND-LEVEL FLOW DIAGRAMS

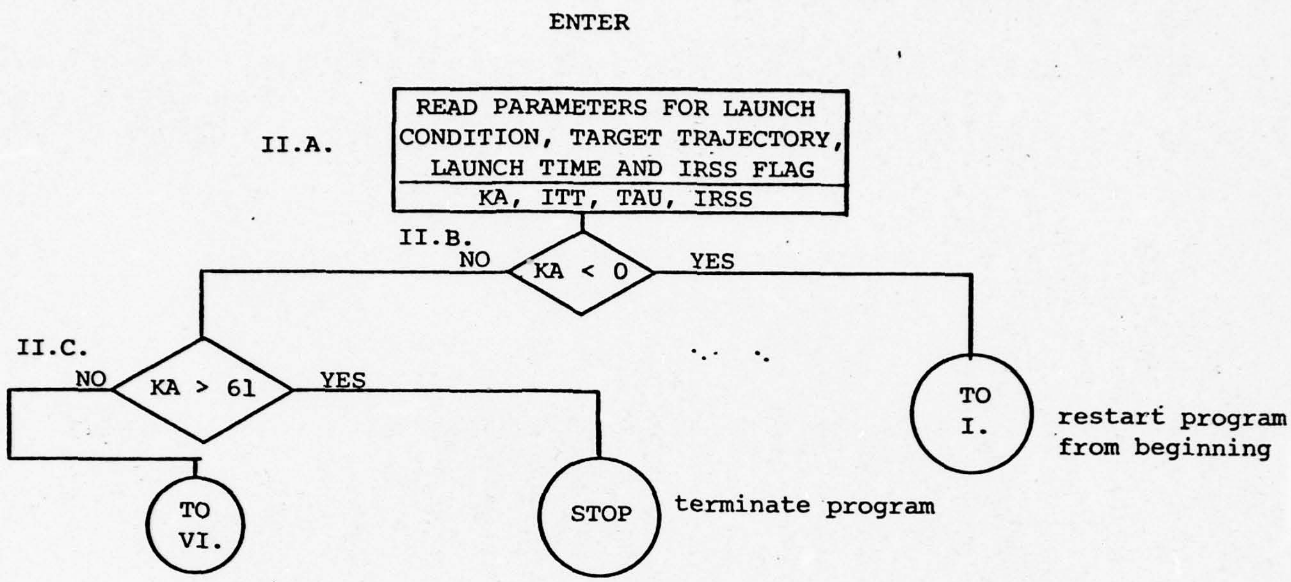
I.

INITIALIZATION SECTION

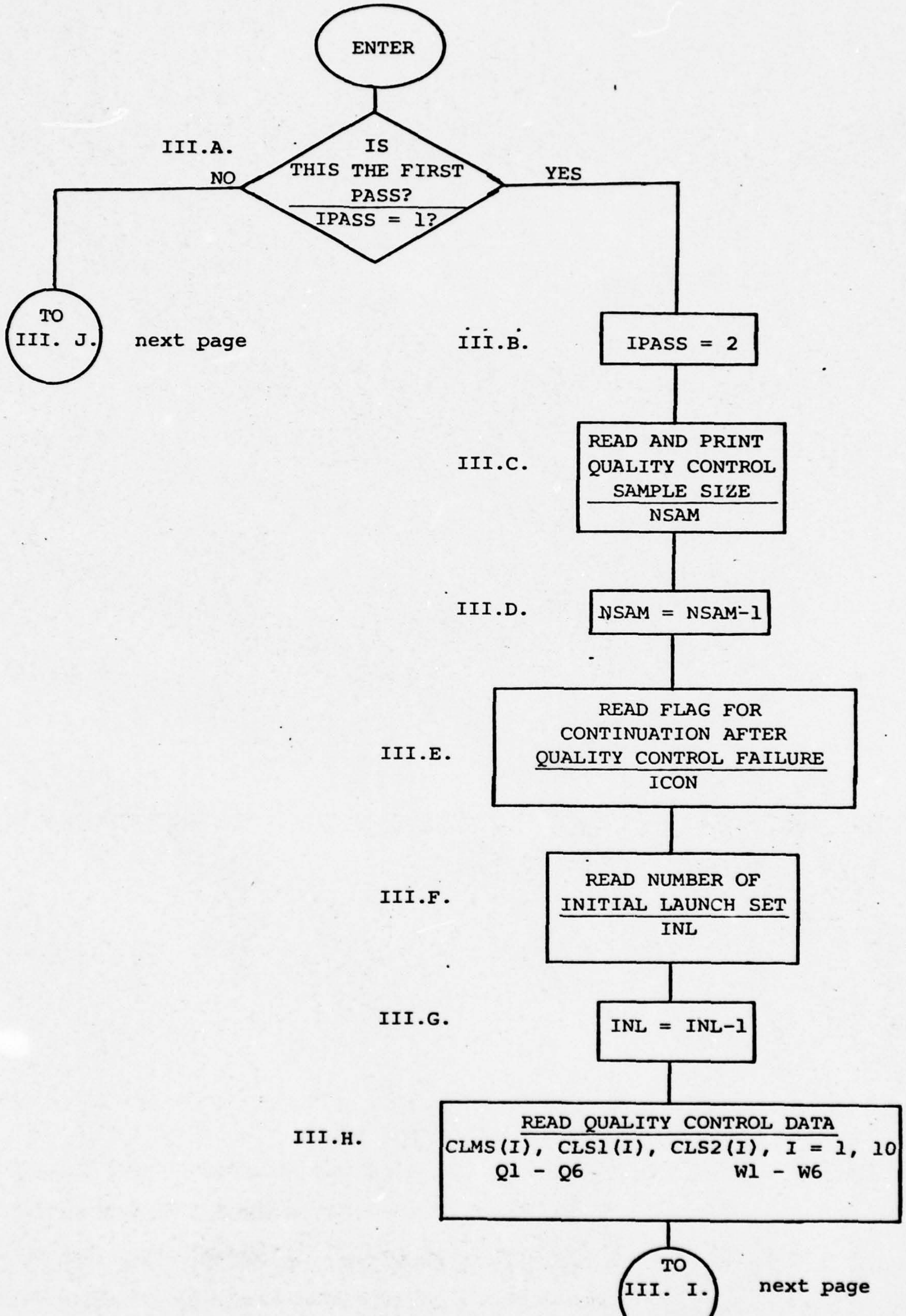


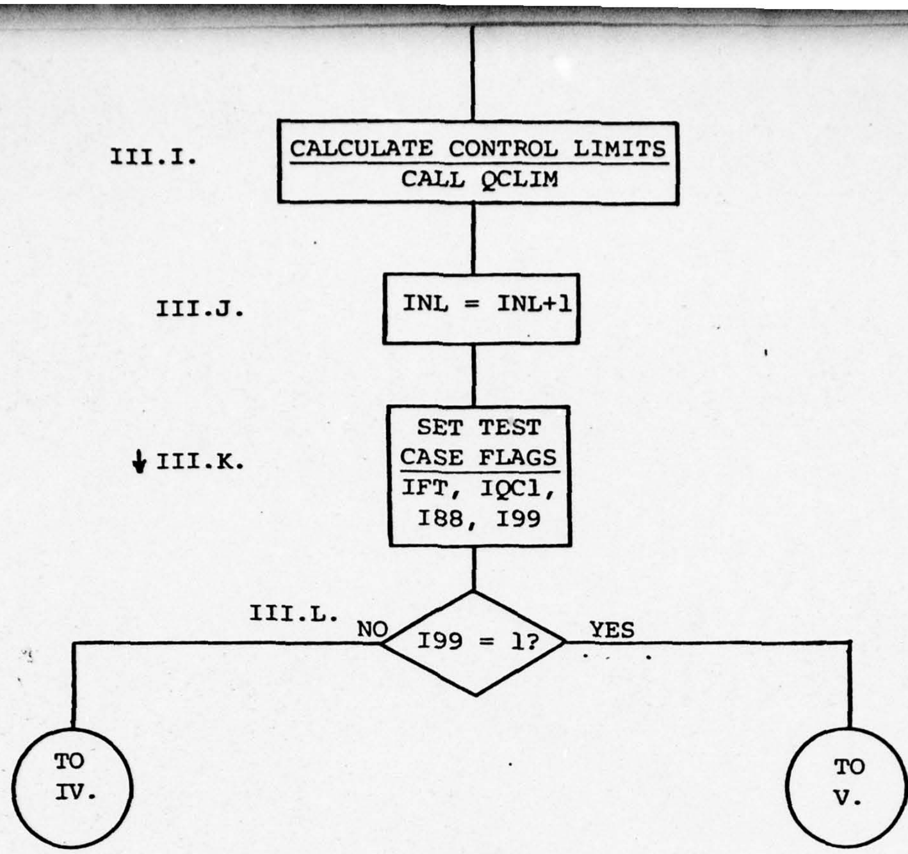
II.

MANUAL SELECTION OF
LAUNCH CONDITIONS



III.
SEQUENCER FOR AUTOMATIC LAUNCH SELECTION

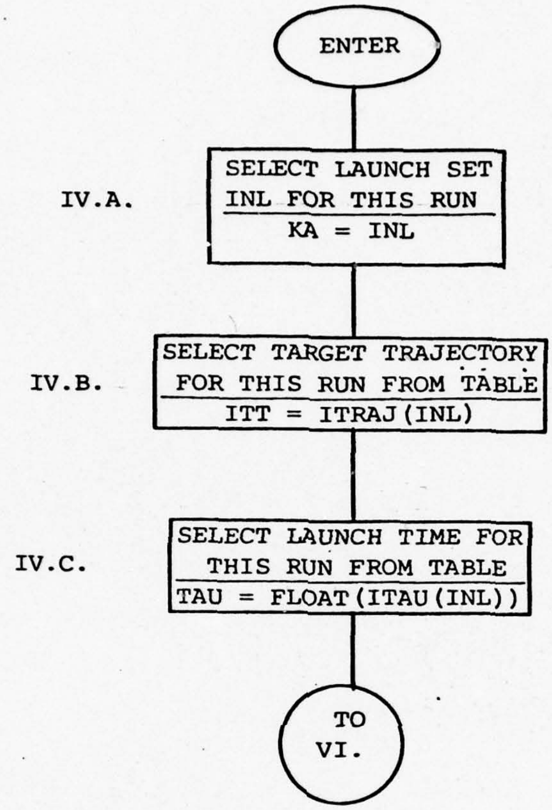



III.I.
CALCULATE CONTROL LIMITS
CALL QCLIM
III.J.
INL = INL+1
III.K.
SET TEST
CASE FLAGS
IFT, IQC1,
I88, I99
III.L.
I99 = 1?
NO
YES
TO
IV.
TO
V.

X

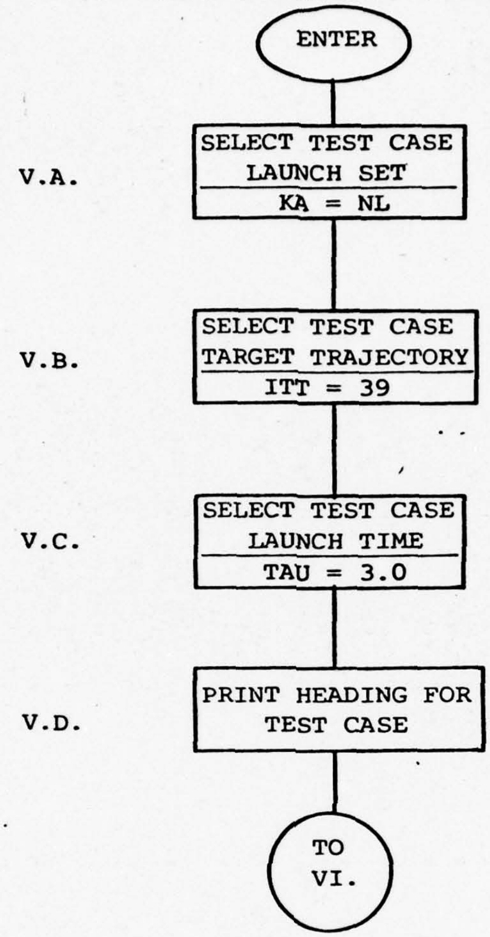
AUTOMATIC

IV.
ATUOMATIC SELECTION
OF LAUNCH CONDITIONS

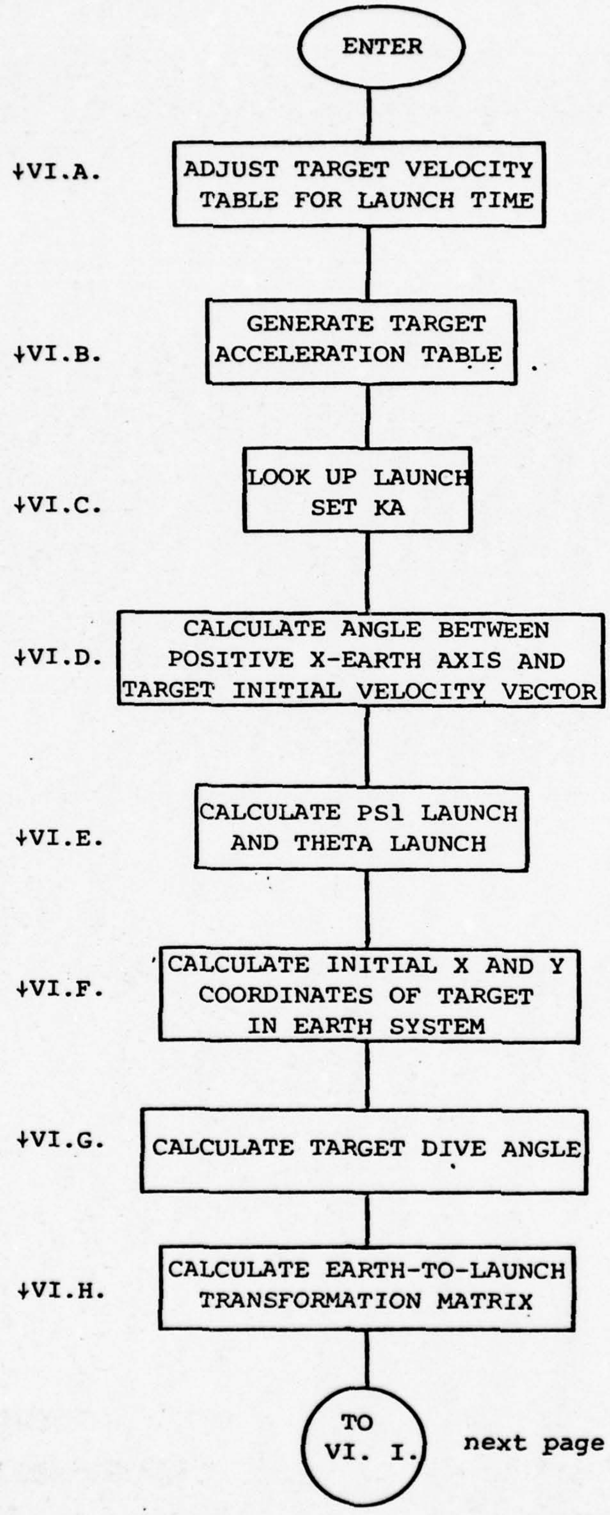


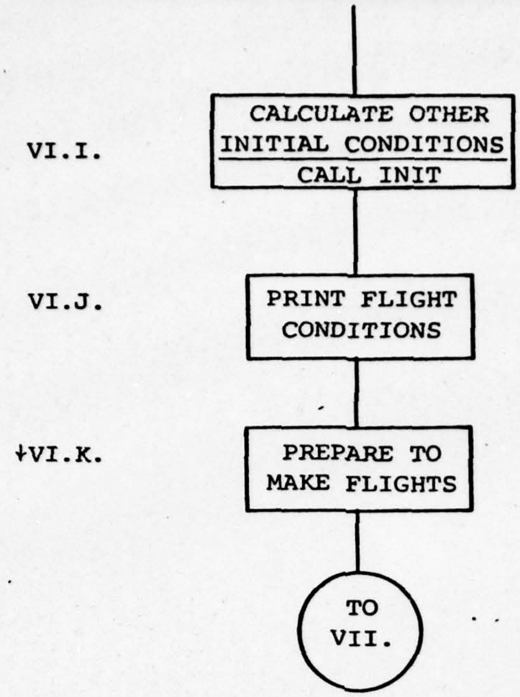
V.

SELECTION OF TEST CASE LAUNCH CONDITIONS

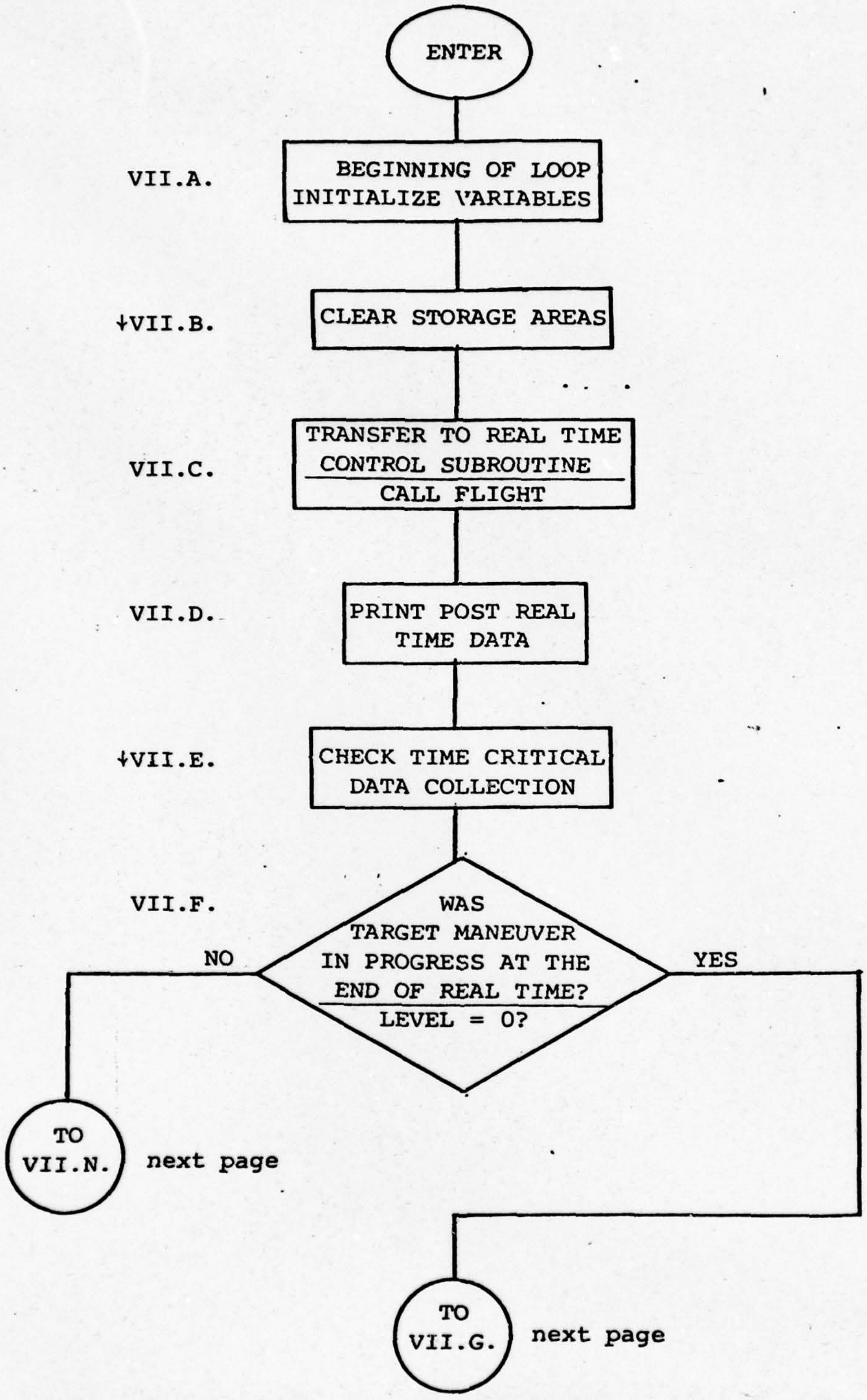


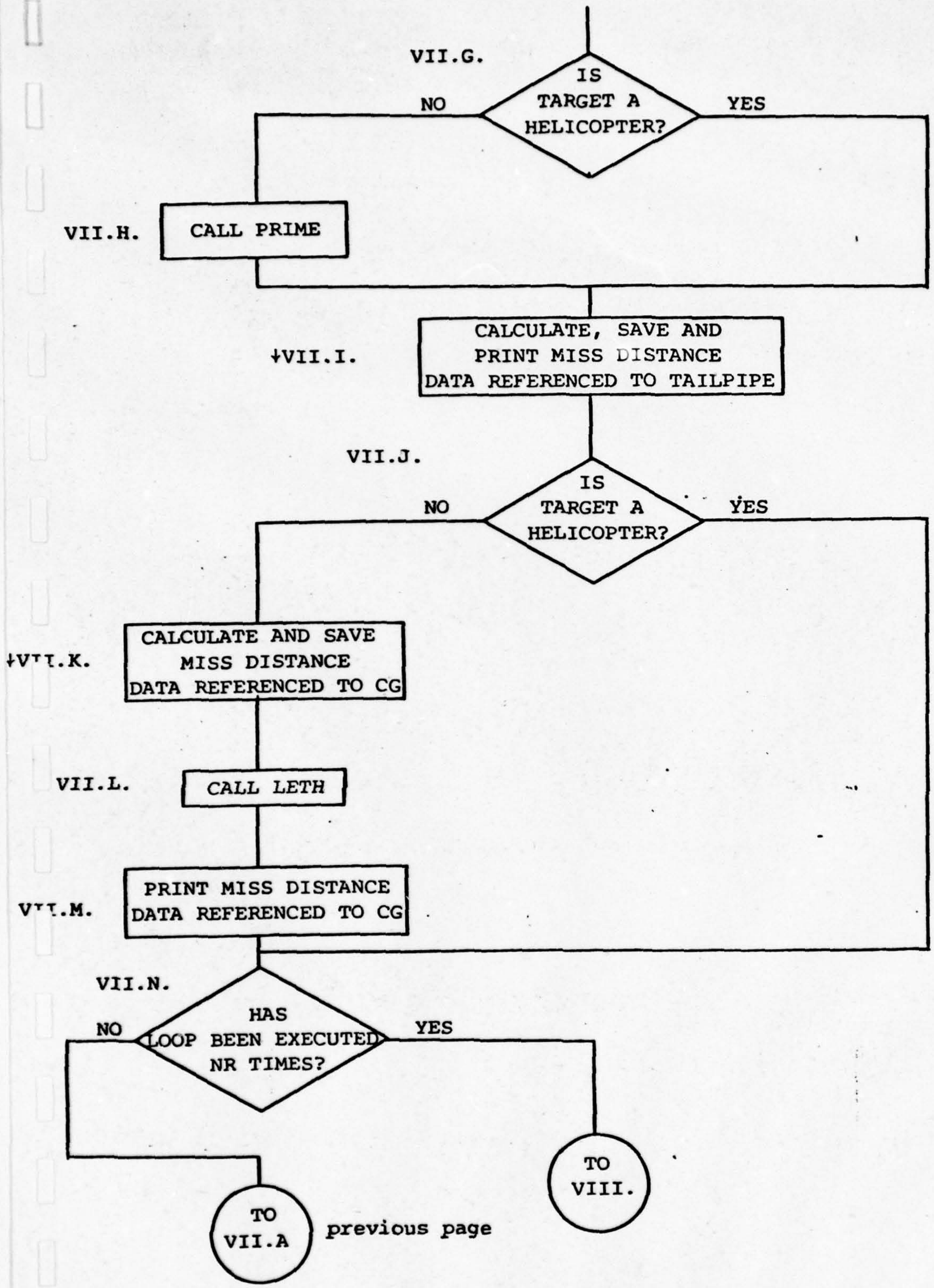
VI.
PRE REAL TIME
SET UP



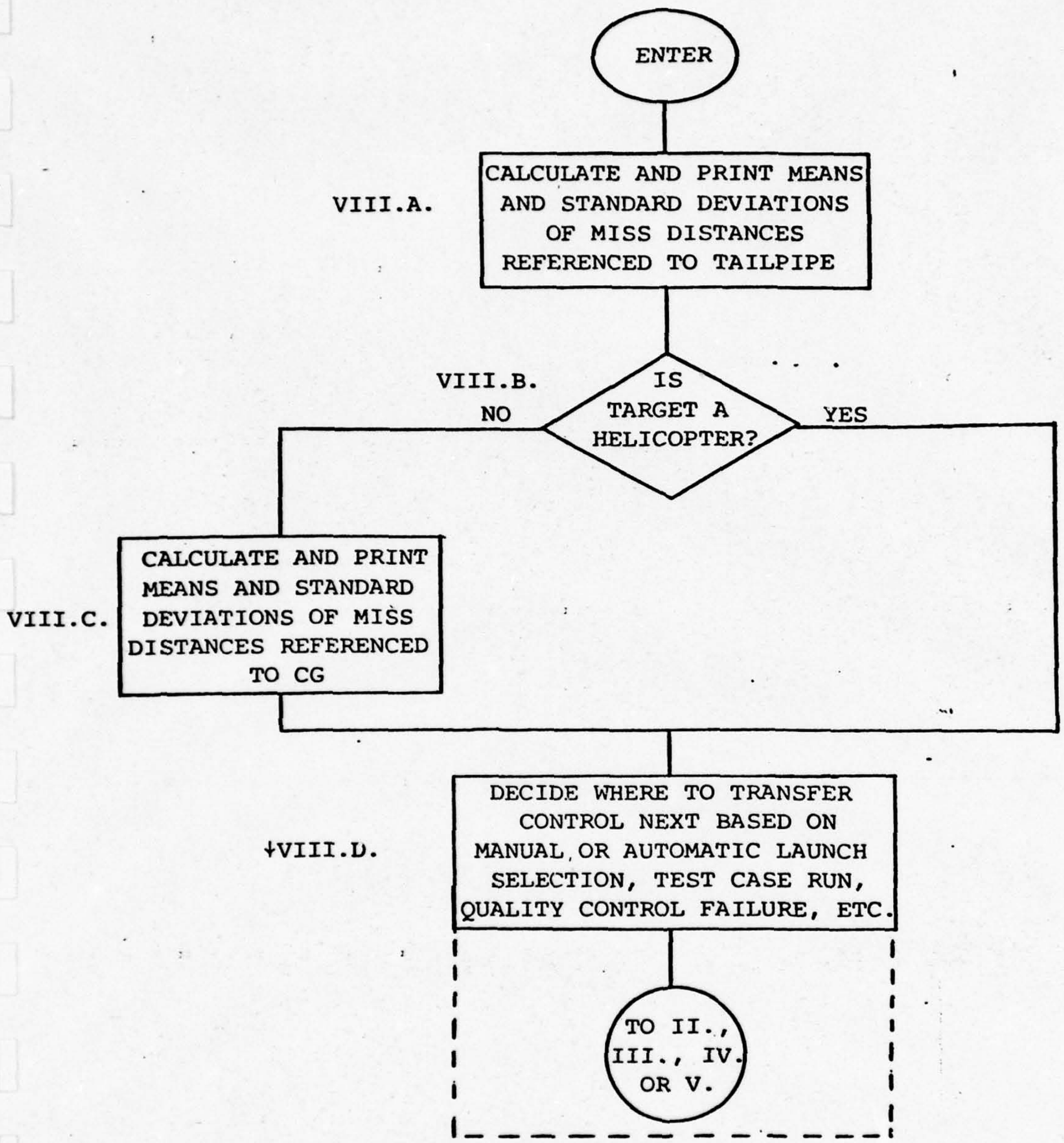

VI.I.
CALCULATE OTHER INITIAL CONDITIONS
CALL INIT
VI.J.
PRINT FLIGHT CONDITIONS
VI.K.
PREPARE TO MAKE FLIGHTS
TO VII.

VII.
FLIGHTS


ENTER
VII.A.
BEGINNING OF LOOP
INITIALIZE VARIABLES
↓VII.B.
CLEAR STORAGE AREAS
VII.C.
TRANSFER TO REAL TIME CONTROL SUBROUTINE
CALL FLIGHT
VII.D.
PRINT POST REAL TIME DATA
↓VII.E.
CHECK TIME CRITICAL DATA COLLECTION
VII.F.
WAS TARGET MANEUVER IN PROGRESS AT THE END OF REAL TIME?
LEVEL = 0?
NO
YES
TO VII.N.
next page
TO VII.G.
next page


VII.G.
IS TARGET A HELICOPTER?
NO
YES
VII.H.
CALL PRIME
VII.I.
CALCULATE, SAVE AND PRINT MISS DISTANCE DATA REFERENCED TO TAILPIPE
VII.J.
IS TARGET A HELICOPTER?
NO
YES
VII.K.
CALCULATE AND SAVE MISS DISTANCE DATA REFERENCED TO CG
VII.L.
CALL LETH
VII.M.
PRINT MISS DISTANCE DATA REFERENCED TO CG
VII.N.
HAS LOOP BEEN EXECUTED NR TIMES?
NO
YES
TO VII.A
previous page
TO VIII.

VIII.
POST FLIGHT COMPUTATIONS AND QUALITY TESTING

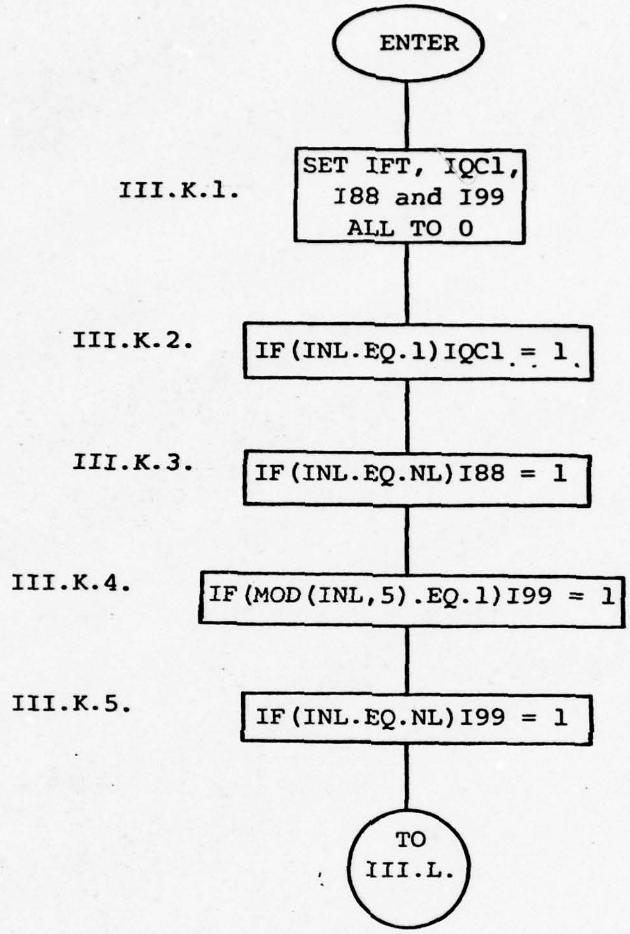


MAIN PROGRAM

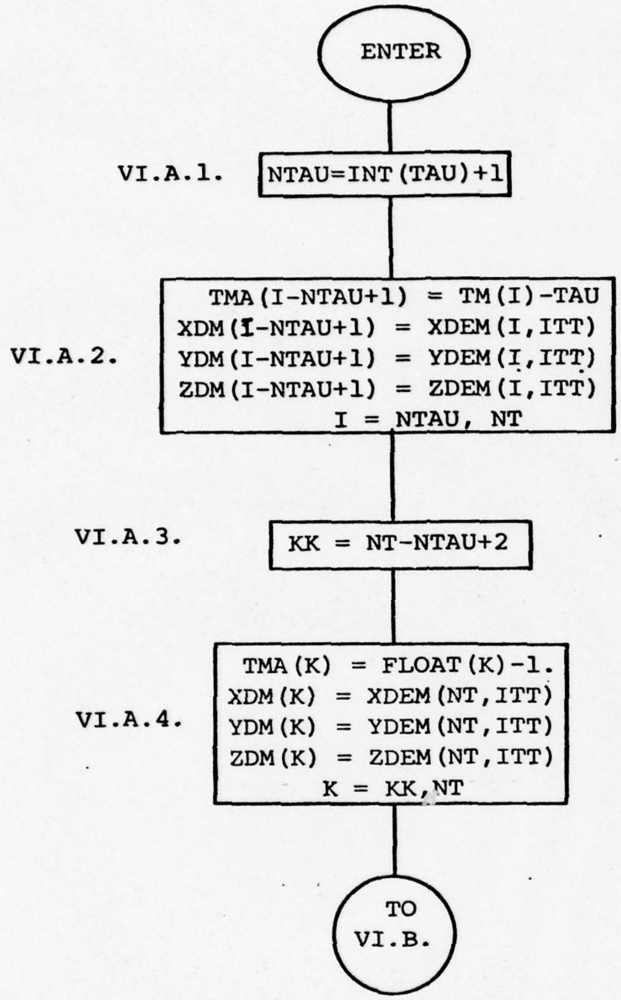
STINGER HYBRID SIMULATION

THIRD LEVEL FLOW DIAGRAMS

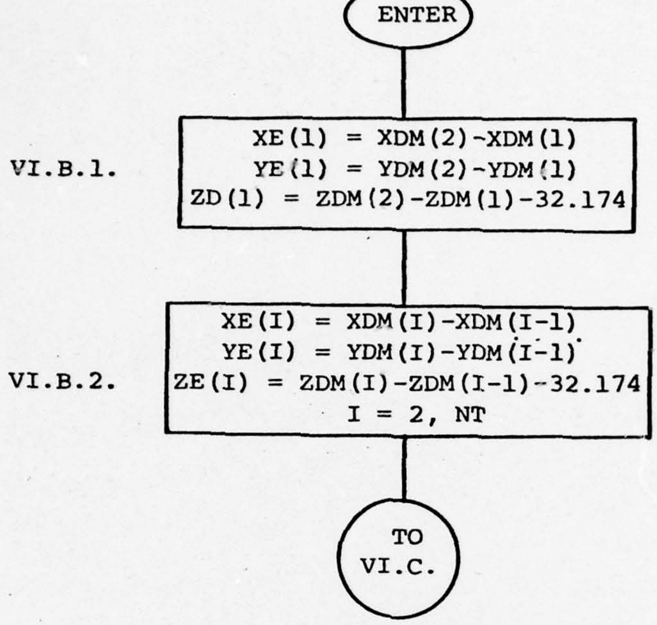
III.K.
SET TEST
CASE FLAGS



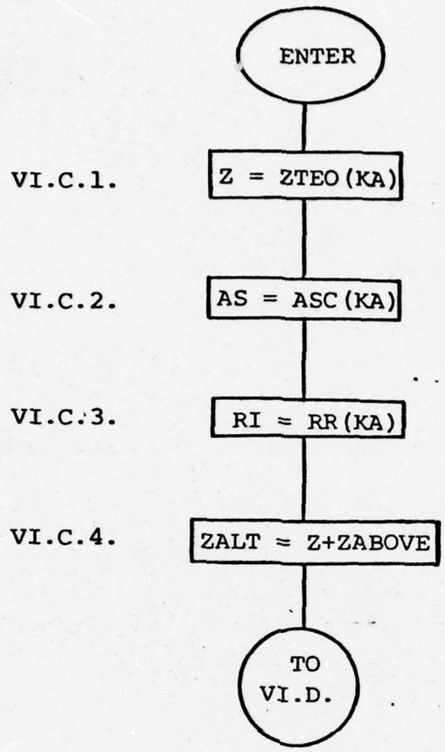
VI.A.
ADJUST TARGET VELOCITY
TABLE FOR LAUNCH TIME



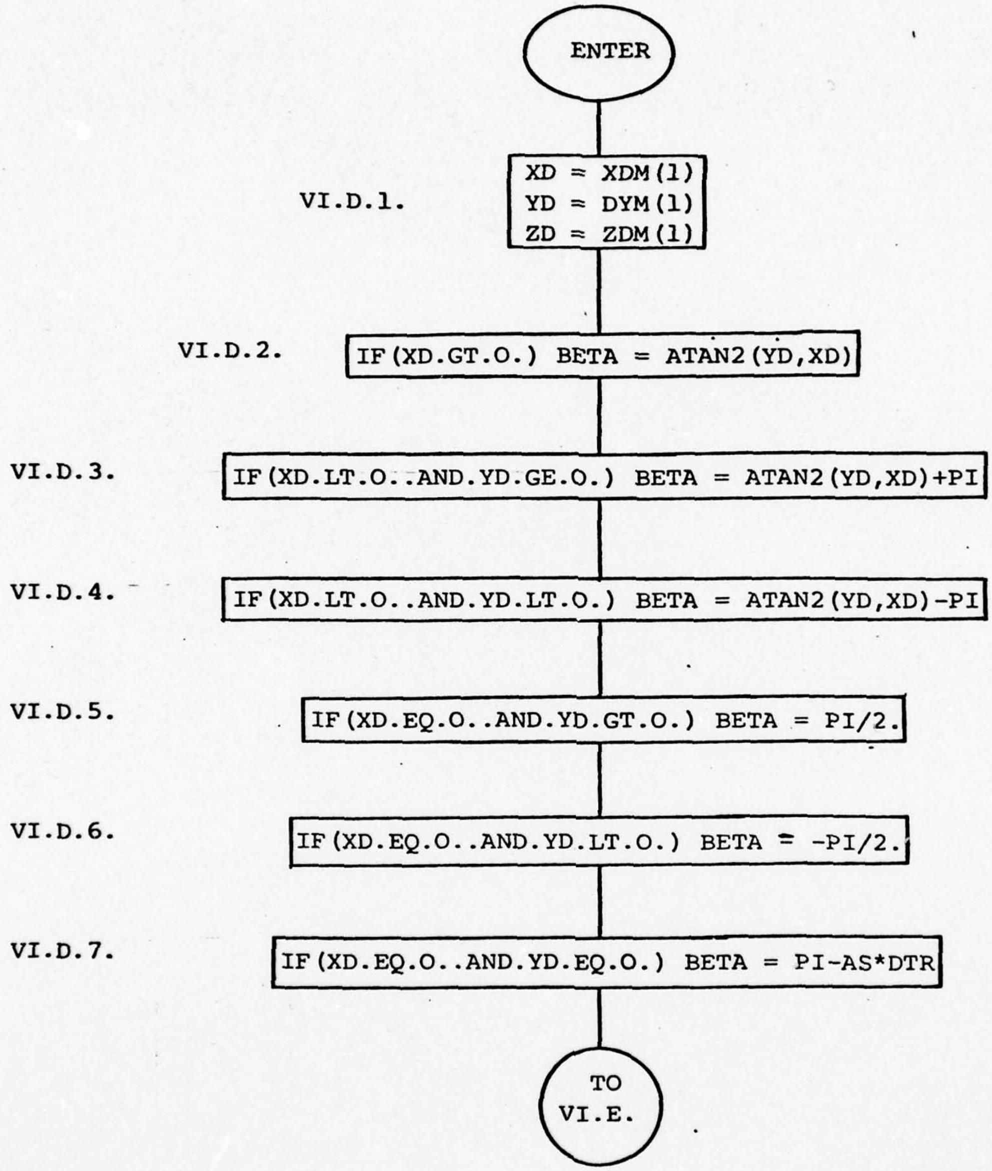
VI.B.
GENERATE TARGET
ACCELERATION TABLE



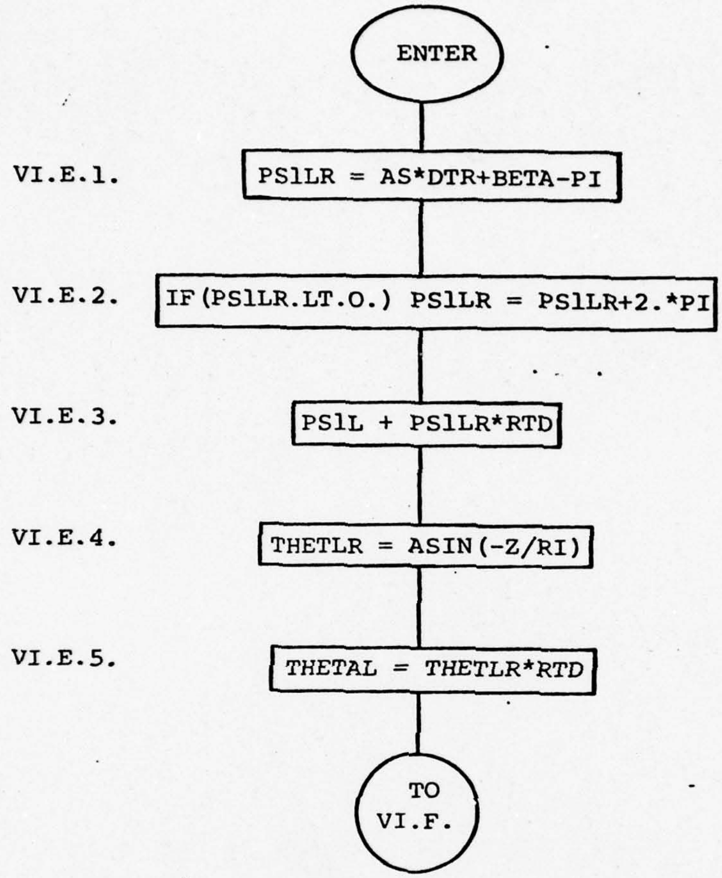
VI.C.
LOOK UP LAUNCH
SET KA



VI.D.
CALCULATE ANGLE BETWEEN
POSITIVE X-EARTH AXIS AND
TARGET INITIAL VELOCITY VECTOR



VI.E.
CALCULATE PS1 LAUNCH
AND THETA LAUNCH



VI.F.
CALCULATE INITIAL X AND Y
COORDINATES OF TARGET
IN EARTH SYSTEM

ENTER

VI.F.1. X = RI*COS(THETLR)*COS(PS1LR)

VI.F.2. Y = RI*COS(THETLR)*SIN(PS1LR)

TO
VI.G.

VI.G.
CALCULATE TARGET
DIVE ANGLE

ENTER

VI.G.1. ARG = SQRT(XD**2+YD**Z)

VI.G.2. IF(ARG.NE.O.) SEO = ATAN2(ZD,ARG)

VI.G.3. IF(ARG.EQ.O..AND.ZD.GT.O.) SEO = PI/2.

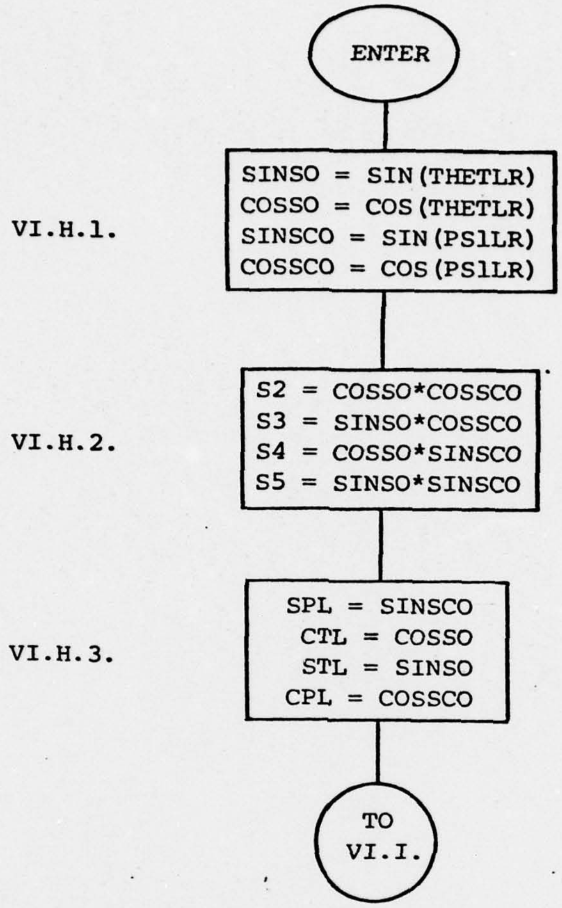
VI.G.4. IF(ARG.EQ.O..AND.ZD.LT.O.) SEO = -PI/2.

VI.G.5. IF(ARG.EQ.O..AND.ZD.EQ.O.) SEO = O.

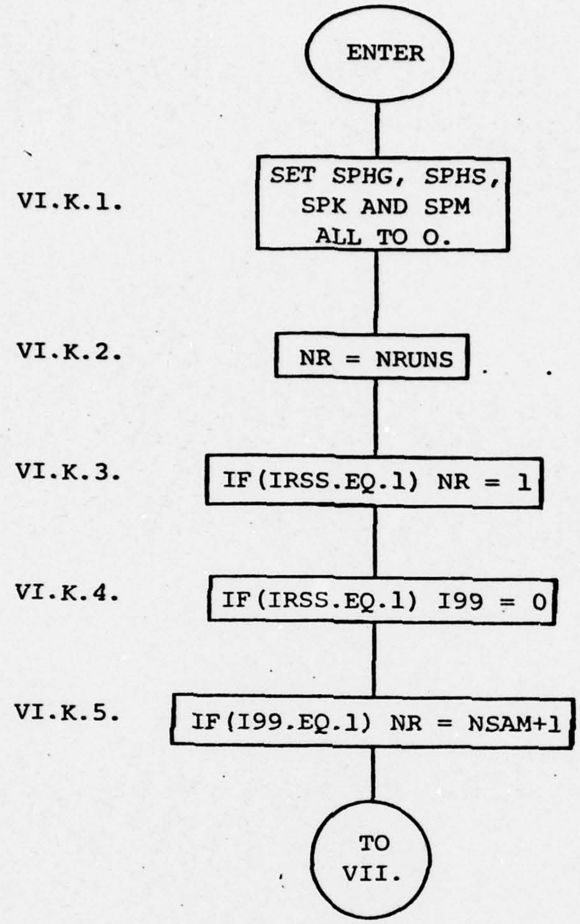
VI.G.6. ASEO = SEO*RTD

TO
VI.H.

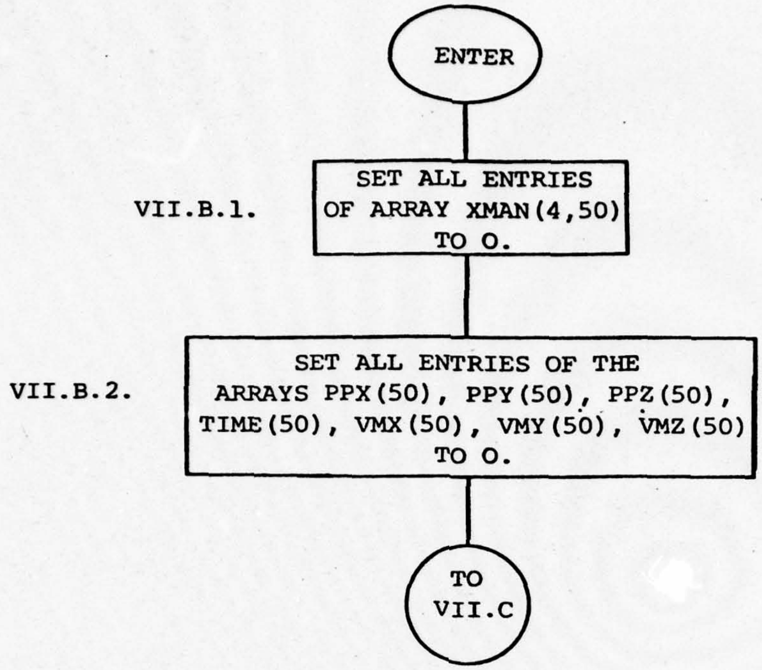
VI.H.
CALCULATE EARTH-TO-LAUNCH
TRANSFORMATION MATRIX



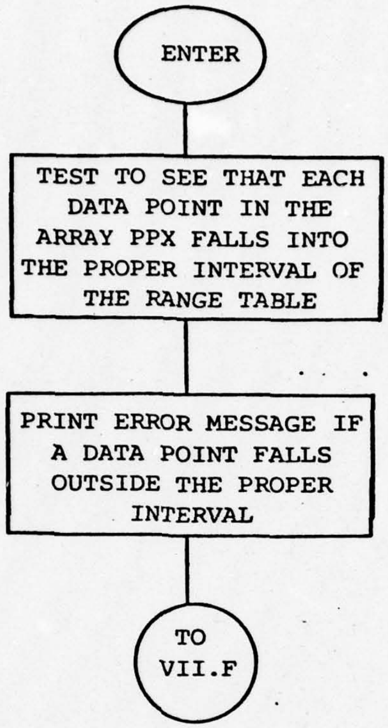
VI.K.
PREPARE TO
MAKE FLIGHTS



VII.B.
CLEAR STORAGE AREAS



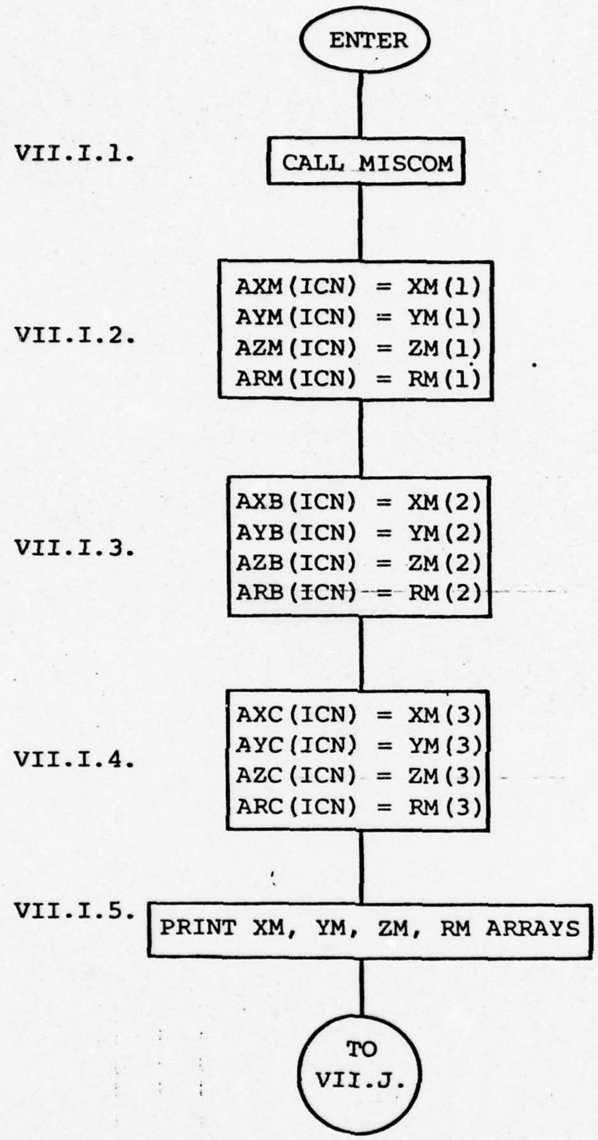
VII.E.
CHECK TIME CRITICAL
DATA COLLECTION



VII.E.1.

VII.E.2.

VII.I.
CALCULATE, SAVE AND PRINT MISS
DISTANCE DATA REFERENCED TO TAILPIPE



VII.K.

CALCULATE AND SAVE MISS DISTANCE
DATA REFERENCED TO CG

ENTER

VII.K.1.
```
AXMT(ICN) = XM(1)
AYMT(ICN) = YM(1)+19.5*YA
AZMT(ICN) = ZM(1)+19.5*ZA
```

VII.K.2.
```
AXBT(ICN) = XM(2)-19.5
AYBT(ICN) = YM(2)
AZBT(ICN) = ZM(2)
```

VII.K.3.
```
AXCT(ICN) = XM(3)-19.5
AYCT(ICN) = YM(3)
AZCT(ICN) = ZM(3)
```

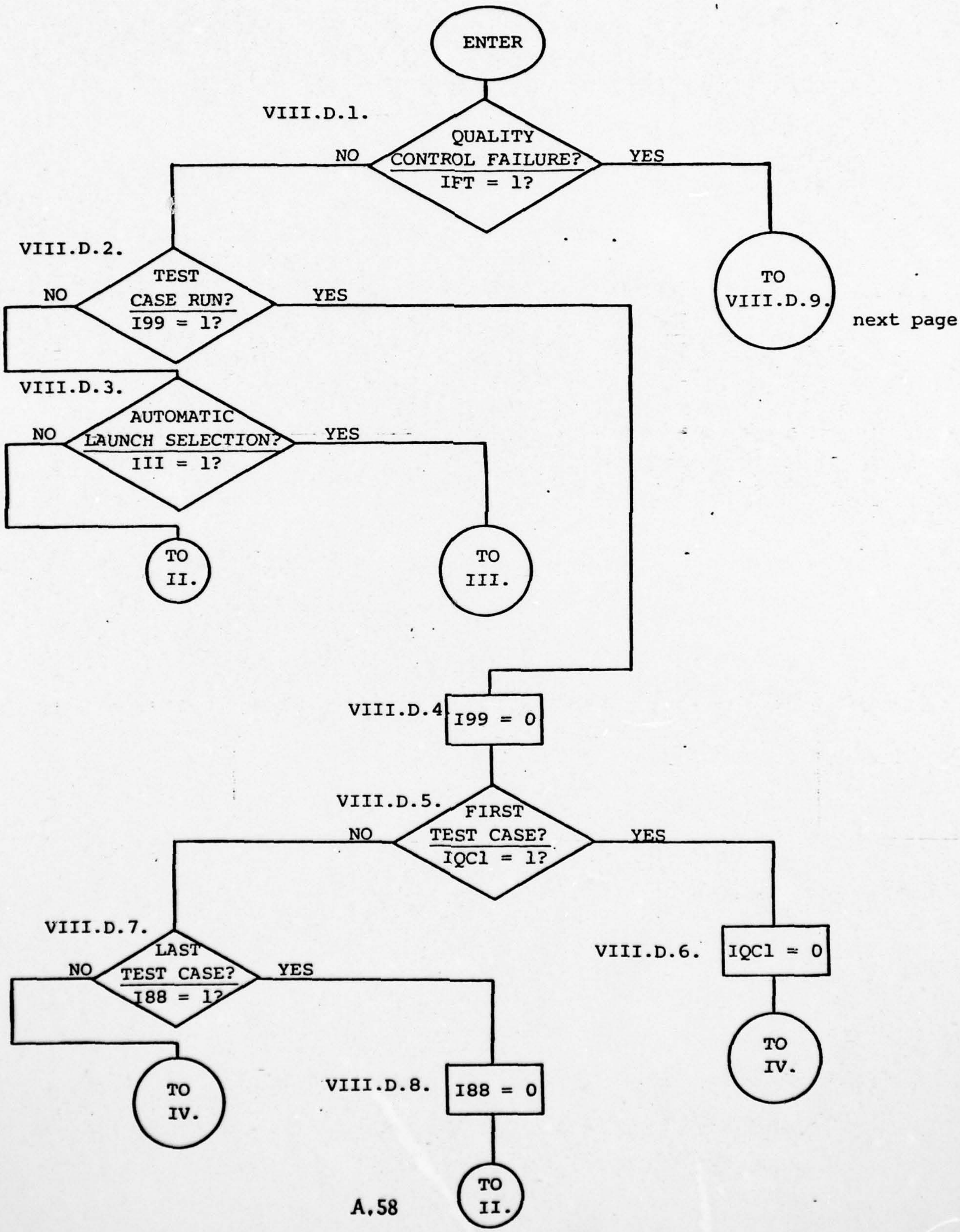
VII.K.4.
```
ARMT(ICN) = SQRT(XM(1)**2+(YM(1)+19.5*YA)**2
   +(ZM(1)+19.5*ZA)**2)
```

VII.K.5.
```
ARBT(ICN) = SQRT((XM(2)-19.5)**2+YM(2)**2
   +ZM(2)**2)
```

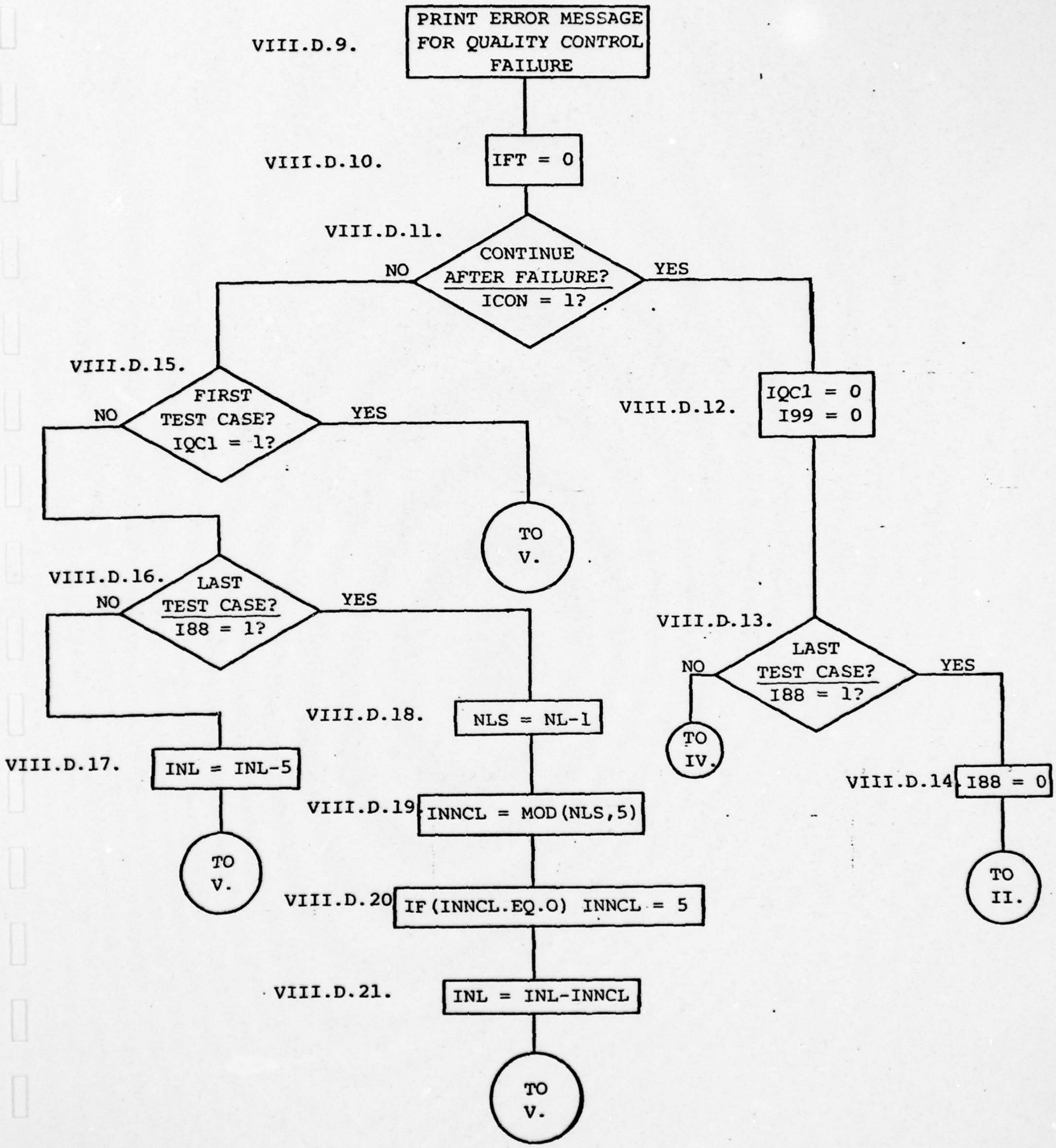
VII.K.6.
```
ARCT(ICN) = SQRT((XM(3)-19.5)**2+YM(3)**2
   +ZM(3)**2)
```

TO VII.L

VIII.D.
DECIDE WHERE TO TRANSFER CONTROL
NEXT BASED ON MANUAL OR AUTOMATIC
LAUNCH SELECTION, TEST CASE RUN, QUALITY
CONTROL FAILURE, ETC.



VIII.D. (Continued)



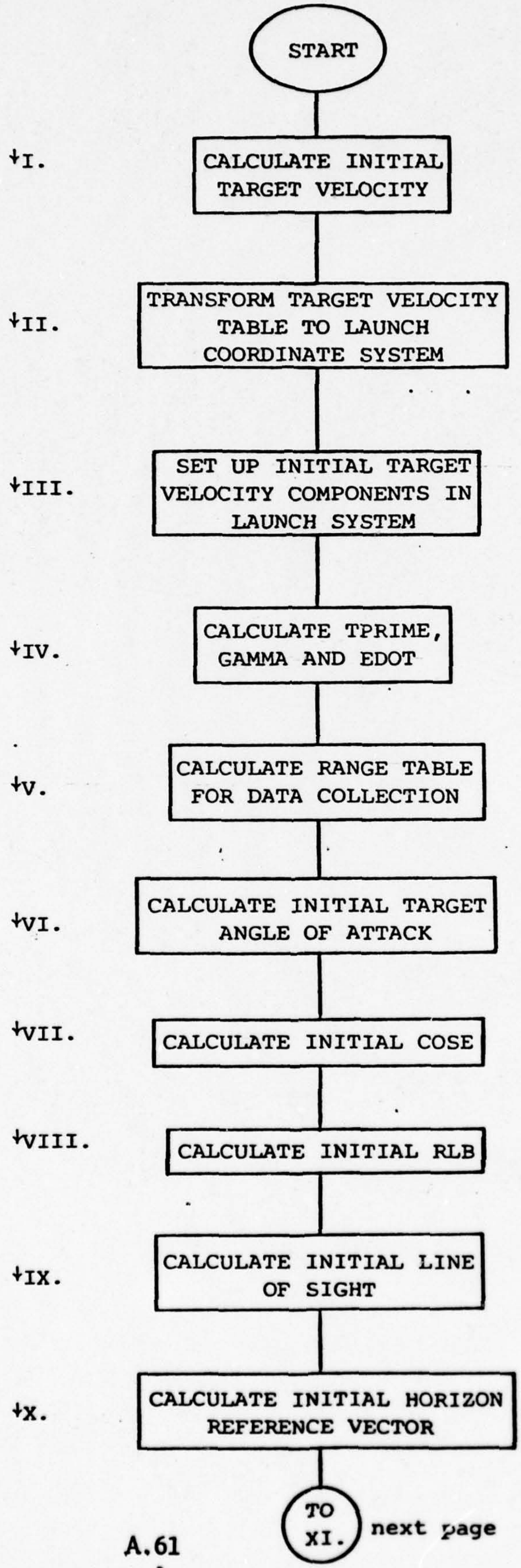
AD-A052 676 B-K DYNAMICS INC ROCKVILLE MD F/G 9/2
SUMMARY REPORT OF STINGER CONVERSION ACTIVITIES.(U)
JUL 76 DAAH01-75-C-0194
UNCLASSIFIED BKD-TR-3-206 NL

3 OF 4
AD
A052676

SUBROUTINE INIT

FIRST LEVEL FLOW DIAGRAM

SUBROUTINE INIT



SUBROUTINE INIT (Continued)

↓XI. CALCULATE INITIAL TARGET CENTER LINE VECTOR

↓XII. CALCULATE INITIAL PLUME ROTATION ANGLE

↓XIII. CALCULATE INITIAL IRIS RATIO 7

RETURN

SUBROUTINE INIT

SECOND LEVEL FLOW DIAGRAMS

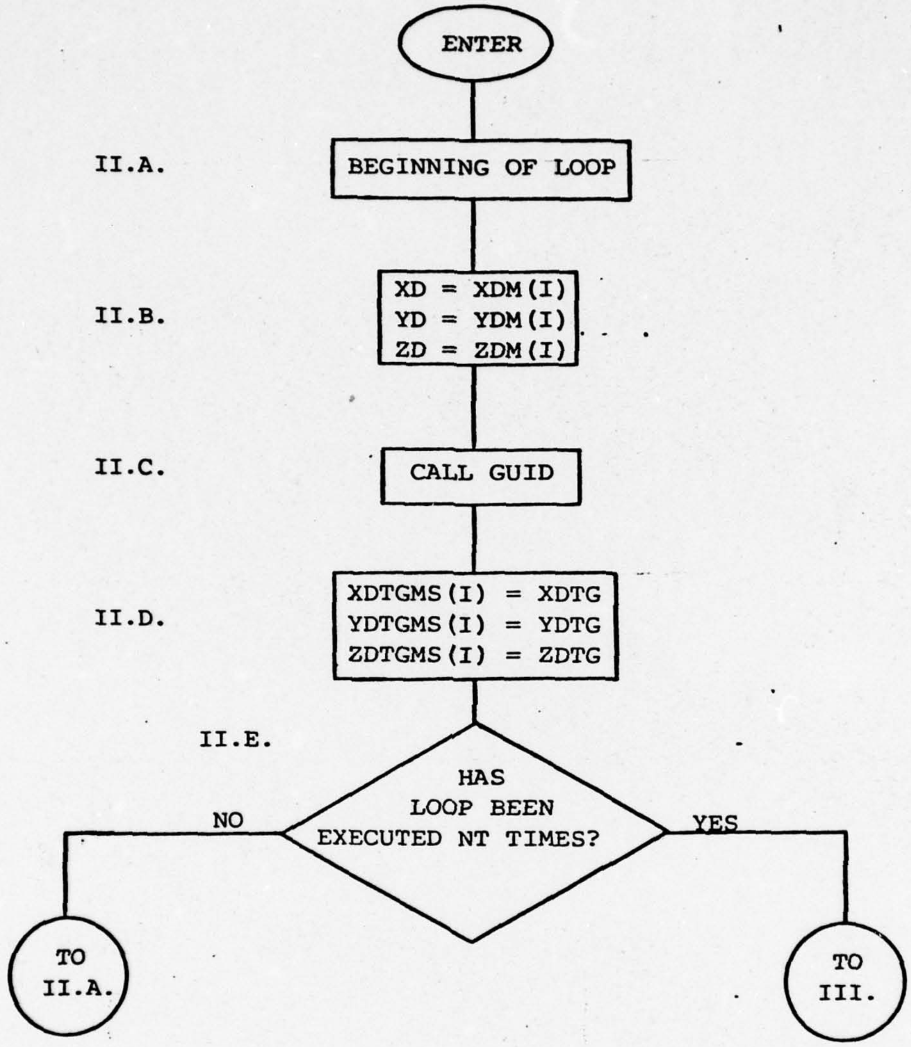
I.
CALCULATE INITIAL
TARGET VELOCITY

ENTER

I.A. VVVV = SQRT(XDM(1)**2+YDM(1)**2+ZDM(1)**2)

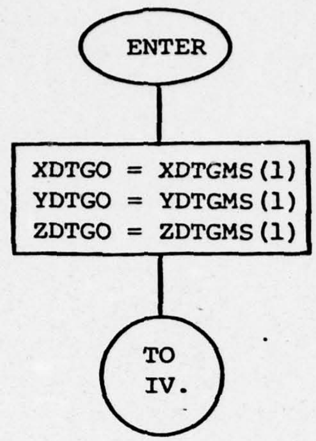
TO
II.

II.
TRANSFORM TARGET VELOCITY
TABLE TO LAUNCH
COORDINATE SYSTEM

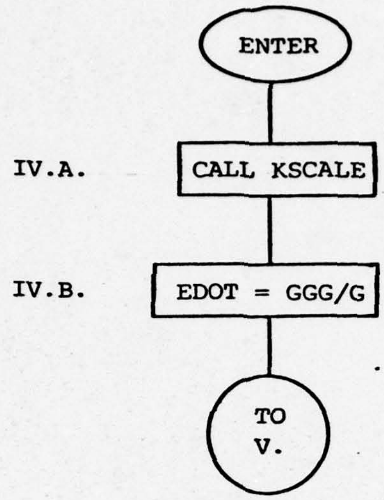


III.
SET UP INITIAL TARGET
VELOCITY COMPONENTS
IN LAUNCH SYSTEM

III.A.



IV.
CALCULATE TPRIME,
GAMMA AND EDOT



V.
CALCULATE RANGE TABLE
FOR DATA COLLECTION

ENTER

V.A.
```
NADJ = NPTS
STPN = NPTS
```

V.B.
```
DIF = (XTERM+(STPN-1.)*DX)-[(20.*100.)/(1.+GGG)]
```

V.C.
```
IF(DIF.GE.O.) NADJ = NPTS-IFIX(DIF/DX)-1
```

V.D.
```
IPTS = NADJ
```

V.E.
```
XXS(NADJ-I+1) = -(XTERM+(I-1)*DX)
I = 1,NADJ
```

TO VI.

VI.
CALCULATE INITIAL TARGET ANGLE OF ATTACK

ENTER

VI.A. PHO = .00237692*EXP(.00003*ZALT)

VI.B. AAA = 1116.89+.003894*ZALT

VI.C. QM = VVVV/AAA

VI.D. NPX = 2
NX = 8

VI.E. CALL INTERP(QM, QMM, CLAA, NX, NPX, CLA, NERR)

VI.F. WT = 18500.
ST = 248.

VI.G. AT = 2.*WT*SQRT(XE(1)**2+YE(1)**2+ZE(1)**2)/(PHO*(VVVV**2)*CLA*ST*32.174)

VI.H. AT = AT*DTR

VI.I. C1 = COS(AT)
S1 = SIN(AT)

TO VII.

VII.
CALCULATE INITIAL COSE

ENTER

VII.A.
```
XD = XDM(1)
YD = YDM(1)
ZD = ZDM(1)
```

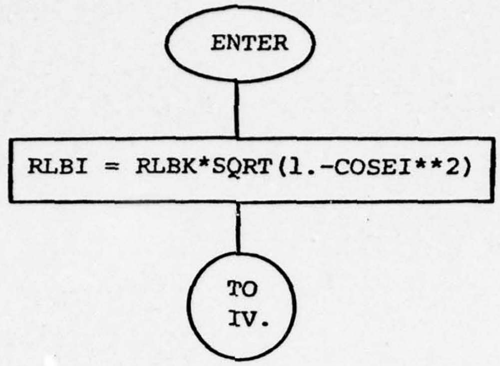
VII.B.
```
S9 = SQRT(XD**2+YD**2)
```

VII.C.
```
COSEI = (STL*(ZD*C1-S9*S1) - (C1+(ZD*S1/S9))*
        XD*S2+YD*S4))/VVVV
```

TO
VIII.

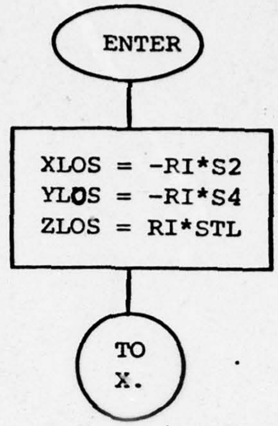
VIII.
CALCULATE INITIAL RLB

VIII.A.

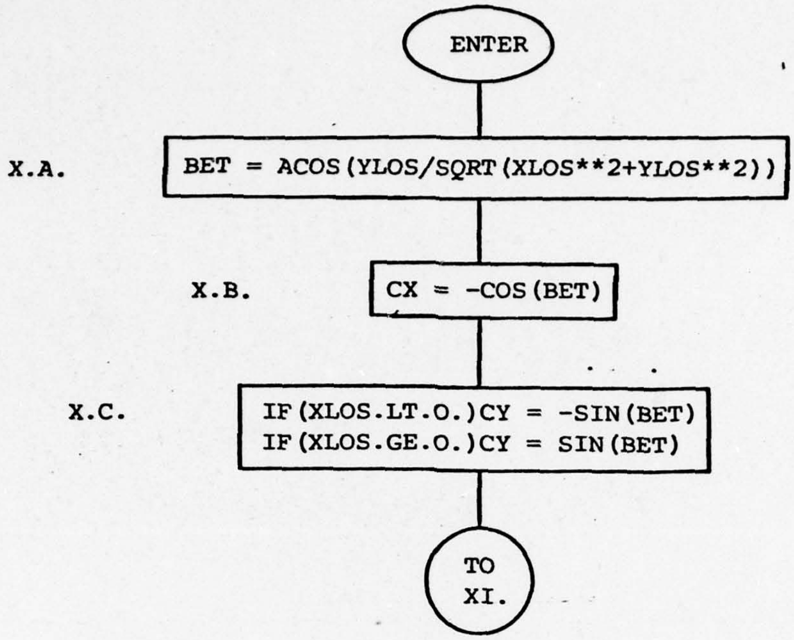


IX.
CALCULATE INITIAL
LINE OF SIGHT

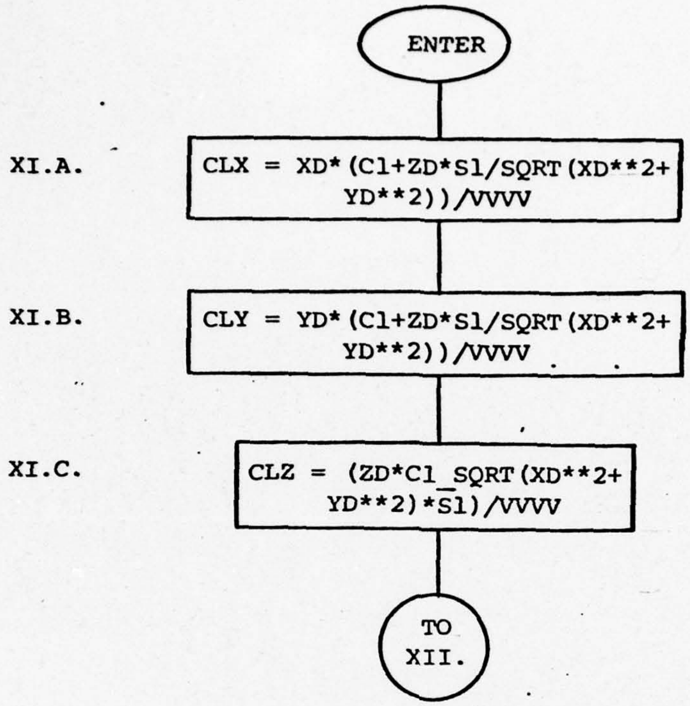
IX.A.



X.
CALCULATE INITIAL HORIZON
REFERENCE VECTOR



XI.
CALCULATE INITIAL TARGET
CENTER LINE VECTOR



XII.
CALCULATE INITIAL PLUME ROTATION ANGLE

ENTER

XII.A. ARG1 = (YLOS*CLZ-ZLOS*CLY)*CX+
(ZLOS*CLX-XLOS*CLZ)*CY

XII.B. ARG2 = SQRT((YLOS*CLZ-ZLOS*CLY)**2+
(ZLOS*CLX-XLOS*CLZ)**2+
(XLOS*CLY-YLOS*CLX)**2)

XII.C. THE = ACOS(ARG1/ARG2)

XII.D. ARG = XLOS*CLY-YLOS*CLX

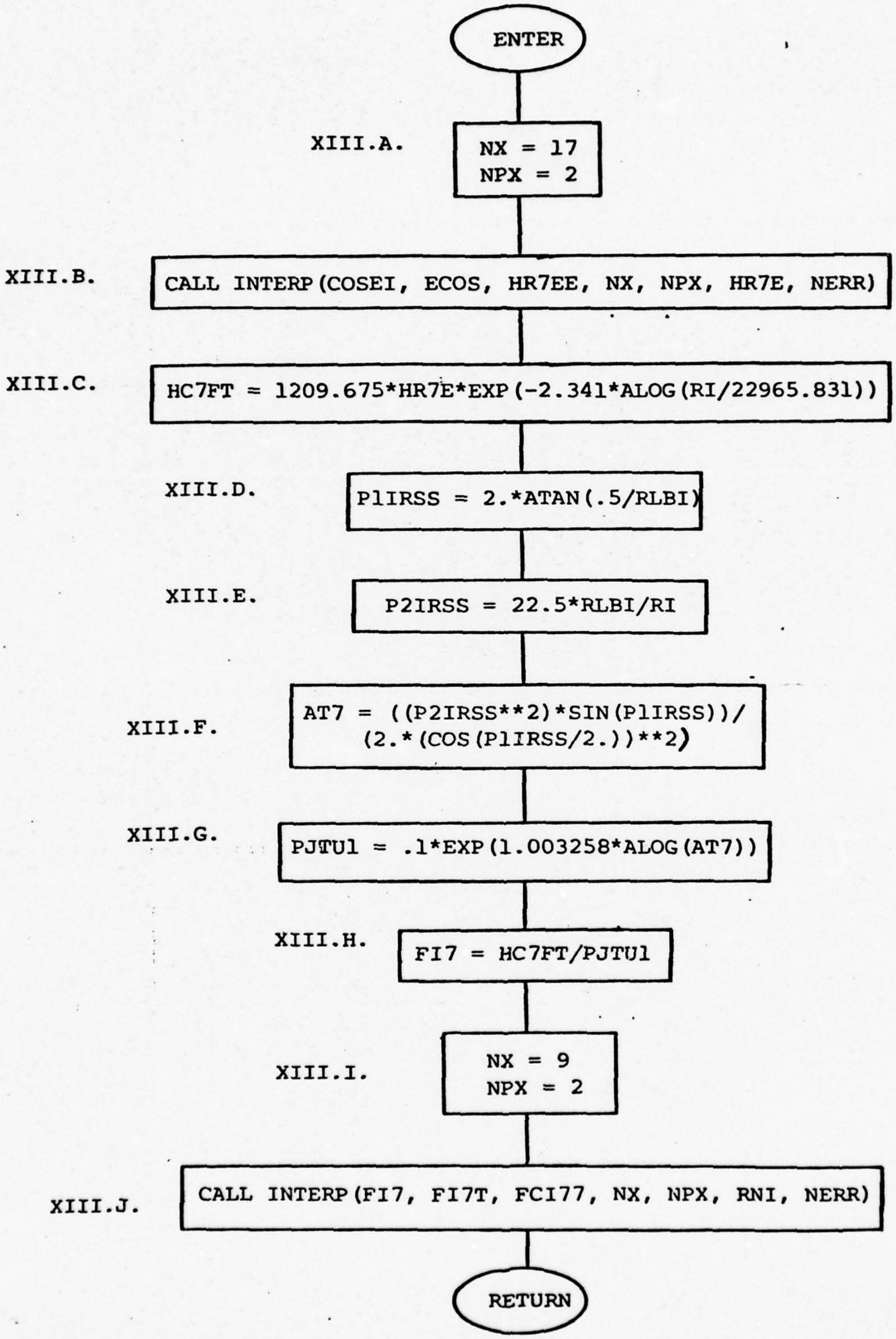
XII.E. IF(ARG.LT.O.) SPOI = PIO2-THE

XII.F. IF(ARG.GE.O..AND.THE.LE.PIO2)
SPOI = PIO2+THE

XII.G. IF(ARG.GE.O..AND.THE.GT.PIO2)
SPOI = THE-3.*PIO2

TO XIII.

XIII.
CALCULATE INITIAL IRIS RATIO 7



APPENDIX B. STRUCTURED MAIN AND SUBROUTINE INIT

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

      PROGRAM MAIN       74/74   OPT=1                    FTNH 4.2+75348     01/12/75  14.30.11.     PAGE     1

            PROGRAM MAIN(INPUT,OUTPUT,HFILE,TAPE5=INPUT,TAPE6=OUTPUT)
      COMMENT.  **************
      COMMENT.  HYBRID SIMULATION CONTROL
      COMMENT.  **************
      C***
      C***
      C     NRUNS IS THE NUMBER OF RUNS PER FLIGHT CONDITION.  MAXIMUM OF 20
      C     XTERM IS THE VALUE OF DELTA X AT WHICH SIMULATION IS TERMINATED
      C     DX IS THE DELTA RANGE BETWEEN COLLECTED DATA POINTS
      C     NPTS IS THE NUMBER OF DATA POINTS COLLECTED
      C***
            COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
           *GAM,EDOT,THETAL,RN,
           *                PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30)
           *               ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
           *               ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
           *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
           *RLOK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
           *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
           *RHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
           *,SA,CA,VMX(50),VMY(50),VMZ(50)
           *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
            COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
           *,XDDE,YDDE,ZDDE
            COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
           *                  XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
           *                ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
            COMMON/GTARG/FXA,FYA,FZA,FXB,FYB,FZB,FXC,FYC,FZC,AT,VT
            COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
           *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
           *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
           *S1P5,A2P5,A1P5,S2P6,S1P5,A2P6,A1P6
            COMMON/EXTRA/NPTS,DX,XTERM,KKK,AS,SEO,SC,ASEO,R,SCALEL,VVVV,C1,
           *XLOS,YLOS,ZLOS,CO,CX,CY,CLY,CLZ,TR?,XX(50),THE
            COMMON /ANG/ SINSO,COSSO,SINSCO,COSSCO
            COMMON/PK/XDH(22),YDH(22),ZDH(22),BDHX(22),BDHY(22),BDHZ(22)
           *,KILL(22),P(4),SPK,SPHG,SPHS,SPM
            COMMON/MISD/XM(3),YM(3),ZM(3),RM(3),NOPT,ICN
            COMMON/JELT/PPXS(50),PPYS(50),PPZS(50),VMXS(50),VMYS(50),VMZS(50)
            COMMON/COMD/COSA,COSB,COSG,YA,ZA
      C***
            REAL   NR
            DIMENSION   ZTEO(62),TM(30)
            DIMENSION   AXM(20),AYM(20),AZM(20),ARM(20),
           *            AXB(20),AYB(20),AZB(20),ARB(20),
           *            AXC(20),AYC(20),AZC(20),ARC(20)
            DIMENSION ASC(62),RR(62),XMT(3),YMT(3),ZMT(3),RMT(3)
            DIMENSION AXMT(20),AYMT(20),AZMT(20),ARMT(20),AXBT(20),AYBT(20),
           *AZBT(20),ARBT(20),AXCT(20),AYCT(20),AZCT(20),ARCT(20)
            INTERRUPT(I=1,R=200,T=500,P=500)
            COMMON/*ADC1/2,
           *IADIN1,IADIN2,IADIN3,IADIN4,IADIN5,IADIN6,
           *IADIN7,IADIN8,IADIN9,IADIN10
            COMMON/*IDIS2/IIN
           *JAM,ON
            COMMON/*DAC1/49,
           *DAOUT1,DAOUT2,DAOUT3,DAOUT4,DAOUT5,DAOUT6,
```

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```
     *DAOUT7,DAOUT8,DAOUT9,DAOUT10,DAOUT11
      COMMON/*ODIS2/IOUT
      JAM,OFF
C***
C*** NEXT CARD IS TAPE SPECIFIC FOR LAUNCH AT WSMR
      DATA ZABOVE/-3989./
      DATA  RTD,DTR/57.2957795,0.01745329/
      DATA(TM(I),I=1,27)/0.,1.,2.,3.,4.,5.,6.,7.,8.,9.,10.,11.,12.,
     *      13.,14.,15.,16.,17.,18.,19.,20.,21.,22.,23.,24.,25.,26./
      SCALE = 102.375
      SCALET = 102.375 / 10.
      SCALEL = 200. * 102.375
      SCALEV=20.*102.375
      SCALE2=6.*1.02375
      SCALED=20.*102.375
      KASE=0
      RLBK=3.3333
   10 CONTINUE
      READ(5,2000) IS1,NSAM,ICON,INL
      PRINT 2012
      PRINT 800
      PRINT 2002, IS1,NSAM,ICON,INL
      PRINT 800
      DO 11 I=1,10
      READ (5,620) CLMS(I),CLS1(I),CLS2(I)
      PRINT 2005, CLMS(I),CLS1(I),CLS2(I)
   11 CONTINUE
      READ (5,621) Q1,Q2,Q3,Q4,Q5,Q6
      PRINT 800
      PRINT 2006, Q1,Q2,Q3,Q4,Q5,Q6
      READ (5,621) W1,W2,W3,W4,W5,W6
      PRINT 800
      PRINT 2007, W1,W2,W3,W4,W5,W6
      CALL CCLIM
      READ (5,902) NRUNS
      PRINT 800
      PRINT 2010, NRUNS
      NR=NRUNS
      IF (NRUNS.LE.20)  GO TO 15
      PRINT 802, NRUNS
      NRUNS = 20
   15 CONTINUE
      READ (5,903) NPTS,DX,XTERM
      PRINT 800
      PRINT 2008, NPTS,DX,XTERM
C*** READ IN LAUNCH CONDITIONS. NL IS NUMBER OF LAUNCH SETS.
      READ (5,902)  NL
      PRINT 800
      PRINT 2011, NL
      IF(NL.LE.61) GO TO 30
      PRINT 823, NL
      GO TO 3
   30 CONTINUE
      PRINT 800
      IF(IS1.NE.1) PRINT 833
C*** READ AND PRINT LOADED LAUNCH CONDITION SETS.
      NLL=NL+1
```

```
      PRINT 800
      DO 40 I=1,NLL
      READ (5,904) ZTEO(I),ASC(I),RR(I)
      ZTE = -ZTEO(I)
      IF(IS1.NE.1) PRINT 835, I,ZTE,ASC(I),RR(I)
   40 CONTINUE
    3 CONTINUE
      PRINT 800
      NT=27
      IQCI=0
      GO TO 42
C*** AUTOMATIC SELECTION OF LAUNCH CONDITIONS.
   41 INL=INL+1
      IFT=0
C     INDEX FOR AUTO TEST CASE CHECK
   63 I99=0
      U77=FLOAT(INL)
      U78=(U77-1.)/5.
      I77=IFIX(U78)
      U79=FLOAT(I77)
      U80=U78-U79
C     TEST FOR EVERY FIFTH LAUNCH SET
      IF(U80.LT.0.01) I99=1
C     TEST FOR FIRST LAUNCH SET
      IF(INL.EQ.1) I99=1
      IF(INL.EQ.1) IQCI=1
C     INDEX FOR OTHER RUNS
      I88=0
C     TEST FOR LAST TEST CASE CHECK
      IF(INL.GT.NL) I88=1
C     TEST CASE CHECK REQUIRED AFTER LAST LAUNCH SET
      IF(INL.GT.NL) I99=1
      IF(I99.EQ.1) GO TO 62
  928 KASE = INL
      KA=KASE
      PRINT 918, KA
      ITT=ITRAJ(INL)
      PRINT 916,ITT
      IT1=ITAU(INL)
      PRINT 917,IT1
      TAU=FLOAT(IT1)
      GO TO 51
   42 READ(5,2000) III,IRSS,KA,ITT,NOGO
      PRINT 800
      PRINT 2003, III,IRSS,KA,ITT,NOGO
      READ(5,2001) TAU
      PRINT 800
      PRINT 2004,TAU
      IF(III.EQ.1) GO TO 41
   51 CONTINUE
    5 PRINT 800
   23 CONTINUE
C*** LAUNCH CONDITIONS HAVE BEEN SELECTED.
      GO TO 51
   62 CONTINUE
      PRINT 625
      TAU=3.0
```

```
C     INDEX FOR TEST CASE DATA CARD OF LAUNCH CONDITIONS
      KA=NL+1
C     INDEX FOR TEST CASE TARGET MANEUVER
C***  NEXT CARD IS TAPE SPECIFIC FOR ITT=39 FOR TEST CASE MANEUVER
      ITT=39
C***  ADJUST FOR TAU AND SCALE TARGET VELOCITY-TIME MANEUVER TABLE.
   51 NTAJ = INT(TAU) + 1
      DO 25 I = NTAU,NT
      K = I - NTAU + 1
      TMA(K)=TM(I)-TAJ
      TMAS(K)=TMA(K)
      XDM(K)=XDEM(I,ITT)
      YDM(K)=YDEM(I,ITT)
      ZDM(K)=ZDEM(I,ITT)
   25 CONTINUE
      KK=NT-INT(TAU)+1
      DO 26 K=KK,NT
      TMA(K)=FLOAT(K)-1.
      XDM(K)=XDEM(NT,ITT)
      YDM(K)=YDEM(NT,ITT)
      ZDM(K)=ZDEM(NT,ITT)
   26 CONTINUE
C***  GENERATE TARGET AERODYNAMIC ACCELERATION TABLE
      XE(1)=XDM(2)-XDM(1)
      YE(1)=YDM(2)-YDM(1)
      ZE(1)=ZDM(2)-ZDM(1)-32.174
      DO 31 I=2,NT
      IV=I-1
      XE(I)=XDM(I)-XDM(IV)
      YE(I)=YDM(I)-YDM(IV)
      ZE(I)=ZDM(I)-ZDM(IV)-32.174
   31 CONTINUE
      KASE=KA
      Z=ZTED(KASE)
      ZZZ=Z+ZABOVE
      ZALT=ZZZ
      AS=ASC(KASE)
      R=RR(KASE)
      XD=XDM(1)
      YD=YDM(1)
      ZD=ZDM(1)
C    CHECK FOR HELICOPTER
      VVVV=SQRT(XD*XD+YD*YD+ZD*ZD)
      IF(VVVV.LT.338.0) PRINT 199
C***
      KKK=0
      IF(XD.NE.0.0.AND.YD.NE.0.0) GO TO 55
      IF(XD.EQ.0.0.AND.YD.GT.0.0) GO TO 53
      IF(XD.EQ.0.0.AND.YD.LT.0.0) GO TO 54
      KKK=1
      SCC=0.0
      ASCO=0.0
      IF(ZD.EQ.0.0) GO TO 52
      IF(ZD.GT.0.0) SEO=90.*DTR
      IF(ZD.LT.0.0) SEO=-90.*DTR
      PRINT 913
      GO TO 60
```

```
   52 PRINT 914
      SED=0.0
      GO TO 60
   53 BETA=90.
      GO TO 55
   54 BETA=270.
      GO TO 56
   55 BETA=ATAN2(YO,XO)*RTD
   56 ASCO=AS+BETA-180.
      IF(ASCO.GT.0.0) GO TO 60
      ASCO=360.+ASCO
   60 CONTINUE
      SCO=ASCO*DTR
      ARG=-Z/R
      SO=ASIN(ARG)
      THETAL=SO*RTD
      ASO=SO*RTD
      X=R*COS(SO)*COS(SCO)
      Y=R*COS(SO)*SIN(SCO)
      PRINT 8C5, ASCO,ASO,R
      PRINT 912,X,Y,Z
C*** CALCULATE CONSTANTS FOR CORDINATE TRANSFORMATION
      SINSO=SIN(SO)
      COSSO=COS(SO)
      SINSCO=SIN(SCO)
      COSSCO=COS(SCO)
      S2=COSSO*COSSCO
      S3=SINSO*COSSCO
      S4=COSSO*SINSCO
      S5=SINSO*SINSCO
      SPL=SINSCO
      CTL=COSSO
      STL=SINSO
      CPL=COSSCO
C*** MAKE EARTH TO GUIDANCE TRANSFORMATION
      CALL GUID
      XDTGO = XDTG
      YDTGO = YDTG
      ZDTGO = ZDTG
C*** CALCULATE SCALE FACTOR EQUATION
      RI=R
      CALL KSCALE,RETURNS(50)
      FDOT=GGG/G
C*** READY TO MAKE FLIGHTS AND COLLECT POSITION POINTS
      SPK=0.
      SPHG=0.
      SPHS=0.
      SPM=0.
      N111=NRUNS
      IF(IRSS.EQ.1) NRUNS=IRSS
      IF(IRSS.EQ.1) NR=IRSS
      IF(IRSS.EQ.1) I99=0
      IF(I99.EQ.1) NRUNS=NSAM+1
      IF(I99.EQ.1) NR=NRUNS
      DO 150 I=1,NRUNS
      CALL INIT
      IF(IS1.NE.1) PRINT 77,RN
```

```
      ICN = I
      XMISS(7) = -77
C***  ZERO STORAGES AREA
      DO 85 J=1,50
      DO 85 K=1,4
      XMAN(K,J) = 0.
   85 CONTINUE
      DO 90 J=1,50
      PPX(J) = 0.0
      PPY(J) = 0.0
      PPZ(J) = 0.0
      TIME(J) = 0.0
      VMX(J) = 0.0
      VMY(J) = 0.0
      VMZ(J) = 0.0
   90 CONTINUE
      IPTS=NADJ
      LEVEL=-7
      CALL FLIGHT
      PRINT 2012
      IF(IS1.EQ.1) GO TO 91
      PRINT 999,RI,GAM,EDOT,XDTGO,YDTGO,ZDTGO,RN,RLB,SPD
      PRINT 999,XCOMP,YCOMP,ZCOMP,G,GGG,XDO,YDO,ZDO,DXG,DYG
      PRINT 999,DZG,S2,S3,S4,S5,RLBK,SCALEP,COSE,F1,F2
      PRINT 999,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR
      PRINT 999,SPL,CTL,STL,CPL,A1,VTI,ZALT,CLA,PHO,ARG
      PRINT 999,AAA,SCALET,TREAL,XTA,YTA,ZTA,SCALEV,QM,SA,CA
      PRINT 996,LEVEL,IPTS,NT,NERR,NPX,NX
      PRINT 999,TRP,XLOS,YLOS,ZLOS,CO,CX,CY,CLY,CLZ,VVVV
      PRINT 999,C1,AS,SEO,SC,ASEO,R,SCALEL,THETAL,THE
   91 CONTINUE
      NOPT = NADJ
C***  SCALE AND WRITE THE POSITION POINTS
      IF(IS1.NE.1) PRINT 808
      IF (XMISS(7).GE.0.)  PRINT 909, XMISS
      IF(IS1.EQ.1) PRINT 809,ICN
      IF(IS1.NE.1) PRINT 810,ICN
   95 IF (IPTS.EQ.0) GO TO 150
      DO 110 J=1,NADJ
      PPXS(J)=PPX(J)
      PPYS(J)=PPY(J)
      PPZS(J)=PPZ(J)
      TIMES(J)=TIME(J)
      VMXS(J)=VMX(J)
      VMYS(J)=VMY(J)
      VMZS(J)=VMZ(J)
      IF(IS1.EQ.1) GO TO 110
      PRINT 811, PPXS(J),PPYS(J),PPZS(J),TIMES(J)
  110 CONTINUE
C     CHECK DIGITAL TIME CRITICAL DATA COLLECTION
      NOK=NADJ-1
      DO 330 M=1,NOK
      XCOMM=-XX(M)
      XCOLL=PPXS(M)
      XCODX=-XX(M+1)
      IF(XCOMM.LT.XCOLL.AND.XCOLL.LT.XCODX) GO TO 330
      GO TO 329
```

```
  330 CONTINUE
      XCOMM=-XX(NADJ)
      XCOLL=PPXS(NADJ)
      XCODX=-XX(NADJ)+DX
      IF(XCOMM.LT.XCOLL.AND.XCOLL.LT.XCODX) GO TO 83
  329 DO 331 M=1,20
  331 PRINT 332
   83 CONTINUE
      IF (LEVEL.LT.0)  GO TO 116
C*** SCALE AND WRITE THE MANEUVER DATA
      IF(IS1.EQ.1) GO TO 111
      PRINT 907
  111 CONTINUE
      DO 114 J=1,NADJ
      IF(IS1.EQ.1) GO TO 114
      PRINT 908, (XMAN(K,J),K=1,4)
  114 CONTINUE
      IF(IS1.NE.1) PRINT 919,XDO,YDO,ZDO
  116 CONTINUE
C*** NEXT CARD IS TAPE SPECIFIC FOR ITT=1 FOR STATIONARY TARGET
      IF(ITT.NE.1.AND.LEVEL.EQ.0.AND.VVVV.GE.338.0) CALL PRIME
      IF(LEVEL.NE.0) GO TO 150
C*** CALCULATE THE MISS-DISTANCE
      CALL MISCOM
      PRINT 815
      PRINT 813
      DO 120 K=1,3
      PRINT 814, XM(K),YM(K),ZM(K),RM(K)
  120 CONTINUE
C*** SAVE THE MISS-DISTANCE DATA
      AXM(ICN) = XM(1)
      AYM(ICN) = YM(1)
      AZM(ICN) = ZM(1)
      ARM(ICN) = RM(1)
      AXB(ICN) = XM(2)
      AYB(ICN) = YM(2)
      AZB(ICN) = ZM(2)
      ARB(ICN) = RM(2)
      AXC(ICN) = XM(3)
      AYC(ICN) = YM(3)
      AZC(ICN) = ZM(3)
      ARC(ICN) = RM(3)
      IF(VVVV.LT.338.0) GO TO 150
      XMT(1)=XM(1)
      YMT(1)=YM(1)+19.5*YA
      ZMT(1)=ZM(1)+19.5*ZA
      XMT(2)=XM(2)-19.5
      YMT(2)=YM(2)
      ZMT(2)=ZM(2)
      XMT(3)=XM(3)-19.5
      YMT(3)=YM(3)
      ZMT(3)=ZM(3)
      AXMT(ICN)=XMT(1)
      AYMT(ICN)=YMT(1)
      AZMT(ICN)=ZMT(1)
      AXBT(ICN)=XMT(2)
      AYBT(ICN)=YMT(2)
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      AZBT(ICN)=ZMT(2)
      AXCT(ICN)=XMT(3)
      AYCT(ICN)=YMT(3)
      AZCT(ICN)=ZMT(3)
      DO 121 K=1,3
  121 RMT(K)=SQRT(XMT(K)**2+YMT(K)**2+ZMT(K)**2)
      PRINT 800
      ARMT(ICN)=RMT(1)
      ARBT(ICN)=RMT(2)
      ARCT(ICN)=RMT(3)
      PRINT 815
      PRINT 813
      DO 122 K=1,3
      PRINT 814, XMT(K),YMT(K),ZMT(K),RMT(K)
  122 CONTINUE
      CALL LETH
C*** GO BACK FOR THE NEXT FLIGHT
  150 CONTINUE
C*** AFTER FLIGHTS HAVE BEEN COMPLETED, CALCULATE MEAN AND STD DEV
      PRINT 815
      PRINT 830
      IPLANE=0
      CALL MEAN (AXM,AYM,AZM,ARM,NRUNS,XM(1),YM(1),ZM(1),RM(1))
      PRINT 831
      CALL MEAN (AXB,AYB,AZB,ARB,NRUNS,XM(2),YM(2),ZM(2),RM(2))
      PRINT 832
      CALL MEAN (AXC,AYC,AZC,ARC,NRUNS,XM(3),YM(3),ZM(3),RM(3))
C*** GO BACK FOR THE NEXT SET OF FLIGHT CONDITIONS
      IF(VVVV.LT.338.0) GO TO 197
      PRINT 800
      PRINT 816
      PRINT 830
      IF(I99.EQ.1) IPLANE = 1
      CALL MEAN (AXMT,AYMT,AZMT,ARMT,NRUNS,XMT(1),YMT(1),ZMT(1),RMT(1))
      PRINT 831
      IF(I99.EQ.1) IPLANE = 2
      CALL MEAN (AXBT,AYBT,AZBT,ARBT,NRUNS,XMT(2),YMT(2),ZMT(2),RMT(2))
      PRINT 832
      IF(I99.EQ.1) IPLANE = 3
      CALL MEAN (AXCT,AYCT,AZCT,ARCT,NRUNS,XMT(3),YMT(3),ZMT(3),RMT(3))
      AARUNS=SPK/NR
      AASUM=SPHG/NR
      ABSUM=SPHS/NR
      ABRUNS=SPM/NR
      PRINT 102,ABRUNS,ABSUM,AASUM,AARUNS
  197 CONTINUE
      NRUNS = N111
      NR = N111
      IF(IFT.NE.1) GO TO 602
      DO 630 I=1,10
  630 PRINT 601
      IFT=3
      IF(ICON.EQ.1) GO TO 635
  609 CONTINUE
      IF(IDC1.EQ.1) GO TO 62
      IF(I88.EQ.1) GO TO 240
      INL=INL-4
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      GO TO 62
  240 INNCL=NC
  241 INNCL=INNCL-5
      IF(INNCL.GT.5) GO TO 241
      I88=0
      INL=INL-INNCL
      GO TO 62
  602 IF(I99.NE.1) GO TO 627
      IF(IQC1.EQ.1) GO TO 626
      IF(I88.EQ.1) GO TO 50
      GO TO 633
  626 IQC1=0
      GO TO 633
  627 IF(IRSS.NE.1) GO TO 50
      GO TO 41
  635 IQC1=0
      IF(I88.EQ.1) GO TO 50
  633 I99=0
      GO TO 623
  198 GO TO 50
  200 CONTINUE
      IF (NJGO.EQ.0) GO TO 300
      GO TO 3
  201 PRINT 840
   77 FORMAT(1H0,10X,17H RANDOM NUMBER IS,E15.8)
  102 FORMAT(1H0,8H        =,F6.4,3X,8H        =,F6.4,3X,8H        =,F6.4,
     *3X,8H        =,F6.4)
  193 FORMAT(10X,37H TARGET IS ASSUMED TO BE A HELICOPTER)
  332 FORMAT(39H TIME CRITICAL DATA COLLECTION FAILURE.)
  300 FORMAT(10X,51H IF AUTOMATIC MODE SELECTION IS PLANNED, SELECT THE
     *         45H DESIRED STARTING LAUNCH SET NUMBER WITH SENSE
     *         10H SWITCHES./
     *      10X,52H IF MANUAL MODE SELECTION IS PLANNED, SENSE SWITCHES
     *         31H WILL BE IGNORED AT THIS POINT./
     *      10X,12H PUSH START.)
  841 FORMAT(19H TEST CASE OUT OF LIMITS //)
  605 FORMAT(10X,49H IF COMPLETE PRINTOUT IS DESIRED, SELECT  1  WITH
     *         16H SENSE SWITCHES./
     *      10X,51H IF ONLY ESSENTIAL PRINTOUT IS DESIRED, SELECT  0
     *         23HWITH SENSE SWITCHES./
     *      10X,12H PUSH START.)
  620 FORMAT(3F6.3)
  621 FORMAT(6F10.4)
  622 FORMAT(10X,49H SELECT THE QUALITY CONTROL TEST CASE SAMPLE SIZE
     *         21H WITH SENSE SWITCHES./
     *      10X,43H SAMPLE SIZE MUST BE IN RANGE 2 THROUGH 11.)
  623 FORMAT(10X,50H IF AUTOMATIC MODE SELECTION IS PLANNED, AND IT IS
     *         49H DESIRED TO CONTINUE IF A QUALITY CONTROL FAILURE
     *          8H OCCURS./
     *      10X,48H THEN SELECT  1  WITH SENSE SWITCHES. OTHERWISE,
     *         13H SELECT  2  .)
  625 FORMAT(//10X,16H TEST CASE .....//)
  540 FORMAT(10X,43H IF THIS IS A MICOM HYBRID/IRSS RUN, SELECT
     *         23H 1 WITH SENSE SWITCHES./
     *      10X,44H IF IT IS NOT, SELECT 2 WITH SENSE SWITCHES./
     *      10X,12H PUSH START.)
  710 FORMAT(10X,46H SELECT TARGET TRAJECTORY WITH SENSE SWITCHES./
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     *        10X,18H THEN PRESS START.)
 715 FORMAT(10X,20H TARGET TRAJECTORY  ,I2,15H  WAS SELECTED./
     *        10X,32H IF THIS IS CORRECT, PUSH START./
     *        10X,36H IF THIS IS WRONG, TURN SWITCHES OFF
     *             16H AND PUSH START.)
 720 FORMAT(10X,49H SELECT POINT TAU ON TARGET TRAJECTORY AT TIME OF
     *             15H MISSILE LAUNCH./10X,20H USE SENSE SWITCHES.)
 725 FORMAT(10X,6H TAU = ,I2,39H  WAS SELECTED. TO CONTINUE, SELECT  1
     *             41H WITH SENSE SWITCH IF TAU=0 WAS SELECTED./
     *        10X,52H IF TAU=0 WAS NOT SELECTED, LEAVE SENSE SWITCHES AS
     *             9HTHEY ARE./
     *        10X,12H PUSH START.)
 800 FORMAT (1H0)
 801 FORMAT(10X 50H SELECT THE LAUNCH CONDITIONS WITH SENSE SWITCHES./
     *         10X 18H THEN PRESS START./
     *         10X 50H TO END RUN, TURN ALL SWITCHES ON AND PRESS START )
 802 FORMAT (10X I5, 39H IS TOO MANY RUNS. IT IS CHANGED TO 20 )
 803 FORMAT(10X,18H LAUNCH CONDITIONS,I5,4X,10H WERE SET./
     *         10X 32H IF THIS IS CORRECT, PUSH START.           /
     *         10X 36H IF THIS IS WRONG, TURN SWITCHES OFF
     *             16H AND PUSH START.)
 805 FORMAT(10X,13H PSI LAUNCH =F7.2,4H DEG,5X,15H THETA LAUNCH =F6.2,
     *4H DEG,5X,16H INITIAL RANGE =F9.2,3H FT)
 809 FORMAT(10X,11H FLIGHT NO. I5)
 810 FORMAT (5X 11H FLIGHT NO. I5,20X 1HX 19X 1HY 19X 1HZ 18X 5H TIME)
 811 FORMAT(20X  4(5X F15.4))
 813 FORMAT (10X 14H                  8X 3H XM 12X 3H YM 12X 3H ZM
     *         12X  3H RM )
 814 FORMAT (24X 3(5X F10.2),E15.8)
 815 FORMAT(10X,23H REFERENCED TO TAILPIPE)
 816 FORMAT(10X,17H REFERENCED TO CG)
 823 FORMAT (5X  I5,5X 20H FOR NL IS TOO LARGE )
 830 FORMAT (1H0 10X 20H Y-Z PLANE - - - - - )
 831 FORMAT (1H0 10X 20H X-Y PLANE - - - - - )
 832 FORMAT (1H0 10X 20H X-Z PLANE - - - - - )
 833 FORMAT (10X 27H TABLE OF LAUNCH CONDITIONS ///)
 835 FORMAT(10X,5H SET I2,5X,11H ALTITUDE =F9.2,2X,3H FT,2X,
     *17H CROSSING ANGLE =F7.2,2X,4H DEG,2X,15H INITIAL RANGE =F10.2,
     *2X,3H FT)
 840 FORMAT (10X 26H END OF RUN.  SIGNING OFF. )
 902 FORMAT(I5)
 903 FORMAT(I10,2F10.0)
 904 FORMAT(3F10.2)
 907 FORMAT (1H0 4X 35H TIME     XD MANEUVER     YD MANEUVER
     *                 15H    ZD MANEUVER)
 908 FORMAT(1X F10.4, 3(3X F8.2,4X))
 909 FORMAT (5H X = F7.4,2X 5H Y = F7.4,2X 5H Z = F7.4,2X 8H XDOT =
     *          F7.4,2X 8H YDOT = F7.4,2X 8H ZDOT = F7.4,8H  MISS= E10.3)
 912 FORMAT(10X,7H XTED =F10.2,3H FT,5X,7H YTED =F10.2,3H FT,5X,
     *7H ZTED =F10.2,3H FT)
 913 FORMAT(10X,62H VERTICAL TARGET TRAJECTORY. CROSSING ANGLE IS NOT A
     *PPLICABLE.)
 914 FORMAT(10X,53H STATIONARY TARGET. CROSSING ANGLE IS NOT APPLICABLE
     *.)
 915 FORMAT(10X,94H PUSH ALL SENSE SWITCHES ON FOR AUTOMATIC OPERATION
     *OR ELSE MANUAL OPERATION WILL BE SELECTED./10X,12H PUSH START.)
 916 FORMAT(10X,19H TARGET TRAJECTORY ,I2)
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  917 FORMAT(10X,7H TAU = ,I2)
  918 FORMAT(////10X,5H SET ,I2)
  919 FORMAT(10X,5HXDO =,F10.4,5X,5HYDO =,F10.4,5X,5HZDO =,F10.4)
  996 FORMAT(6I5)
  999 FORMAT(10(1X,E11.4))
 2000 FORMAT(8I5)
 2001 FORMAT(F10.0)
 2002 FORMAT (5X,6HIS1 = ,I5,5X,7HNSAM = ,I5,5X,7HICON = ,I5,5X,6HINL =
     1,I5)
 2003 FORMAT (5X,6HIII = ,I5,5X,7HIRSS = ,I5,5X,5HKA = ,I5,5X,6HITT = ,I
     15,5X,7HNOGO = ,I5)
 2004 FORMAT (5X,6HTAU = ,F10.5)
 2005 FORMAT (5X,7HCLMS = ,F10.5,5X,7HCLS1 = ,F10.5,5X,7HCLS2 = ,F10.5)
 2006 FORMAT (5X,5HQ1 = ,F10.5,5X,5HQ2 = ,F10.5,5X,5HQ3 = ,F10.5,5X,5HQ4
     1 = ,F10.5,5X,5HQ5 = ,F10.5,5X,5HQ6 = ,F10.5)
 2007 FORMAT (5X,5HW1 = ,F10.5,5X,5HW2 = ,F10.5,5X,5HW3 = ,F10.5,5X,5HW4
     1 = ,F10.5,5X,5HW5 = ,F10.5,5X,5HW6 = ,F10.5)
 2008 FORMAT (5X,7HNPTS = ,I5,5X,5HDX = ,F10.5,5X,8HXTERM = ,F10.5)
 2009 FORMAT (5X,7HZTEO = ,F10.5,5X,6HASC = ,F10.5,5X,5HRR = ,F10.5)
 2010 FORMAT (5X,8HNRUNS = ,I5)
 2011 FORMAT (5X,5HNL = ,I5)
 2012 FORMAT(1H1)
 300  STOP
      END
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SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
4547 MAIN

VARIABLES		SN TYPE		RELOCATION					
1621	AAA	REAL		COMA	10106	AARUNS	REAL		
10107	AASUM	REAL			10111	ABRUNS	REAL		
10110	ABSUM	REAL			10463	ARB	REAL	ARRAY	
11253	ARBT	REAL	ARRAY		10603	ARC	REAL	ARRAY	
11373	ARCT	REAL	ARRAY		1620	ARG	REAL		COMA
10343	ARM	REAL	ARRAY		11133	ARMT	REAL	ARRAY	
4	AS	REAL		EXTRA	10627	ASC	REAL	ARRAY	
10071	ASCO	REAL			7	ASEO	REAL		EXTRA
10074	ASO	REAL			11	AT	REAL		GTARG
10367	AXB	REAL	ARRAY		11157	AXBT	REAL	ARRAY	
10507	AXC	REAL	ARRAY		11277	AXCT	REAL	ARRAY	
10247	AXM	REAL	ARRAY		11037	AXMT	REAL	ARRAY	
10413	AYB	REAL	ARRAY		11203	AYBT	REAL	ARRAY	
10533	AYC	REAL	ARRAY		11323	AYCT	REAL	ARRAY	
10273	AYM	REAL	ARRAY		11063	AYMT	REAL	ARRAY	
10437	AZB	REAL	ARRAY		11227	AZBT	REAL	ARRAY	
10557	AZC	REAL	ARRAY		11347	AZCT	REAL	ARRAY	
10317	AZM	REAL	ARRAY		11107	AZMT	REAL	ARRAY	
1444	A1	REAL		COMA	64	A1P1	REAL		COMP
70	A1P2	REAL		COMP	74	A1P3	REAL		COMP
100	A1P4	REAL		COMP	104	A1P5	REAL		COMP
110	A1P6	REAL		COMP	63	A2P1	REAL		COMP
67	A2P2	REAL		COMP	73	A2P3	REAL		COMP
77	A2P4	REAL		COMP	103	A2P5	REAL		COMP
107	A2P6	REAL		COMP	102	BDHX	REAL	ARRAY	PK
130	BDHY	REAL	ARRAY	PK	156	BDHZ	REAL	ARRAY	PK
10072	BETA	REAL			1702	CA	REAL		COMA
1602	CLA	REAL		COMA	1605	CLAA	REAL	ARRAY	COMA
3	CLMS	REAL	ARRAY	COMP	15	CLS1	REAL	ARRAY	COMP
27	CLS2	REAL	ARRAY	COMA	22	CLY	REAL		EXTRA
23	CLZ	REAL		EXTRA	17	CO	REAL		EXTRA
0	COSA	REAL		COMD	1	COSB	REAL		COMD
70	COSE	REAL		COMA	2	COSG	REAL		COMD
3	COSSCO	REAL		ANG	1	COSSO	REAL		ANG
1443	CPL	REAL		COMA	1441	CTL	REAL		COMA
20	CX	REAL		EXTRA	21	CY	REAL		EXTRA
13	C1	REAL		EXTRA	502160	DAOUT1	REAL		
502171	DAOUT10	REAL			502172	DAOUT11	REAL		
502161	DAOUT2	REAL			502162	DAOUT3	REAL		
502163	DAOUT4	REAL			502164	DAOUT5	REAL		
502165	DAOUT6	REAL			502166	DAOUT7	REAL		
502167	DAOUT8	REAL			502170	DAOUT9	REAL		
1160	DELTAR	REAL	ARRAY	COMA	6144	DTR	REAL		
1	DX	REAL		EXTRA	1261	DXG	REAL		COMA
1262	DYG	REAL		COMA	1263	DZG	REAL		COMA
2131	ECOS	REAL	ARRAY	COMA	74	EDOT	REAL		COMA
2204	FCI77	REAL	ARRAY	COMA	2173	FI7T	REAL	ARRAY	COMA
0	FXA	REAL		GTARG	3	FXB	REAL		GTARG
6	FXC	REAL		GTARG	1	FYA	REAL		GTARG
4	FYB	REAL		GTARG	7	FYC	REAL		GTARG
2	FZA	REAL		GTARG	5	FZB	REAL		GTARG

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    SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
  4547 MAIN

 VARIABLES     SN  TYPE           RELOCATION
   1621  AAA       REAL                 COMA         10106  AARUNS    REAL
  10107  AASUM     REAL                              10111  ABRUNS    REAL
  10110  ABSUM     REAL                              10463  ARB       REAL       ARRAY
  11253  ARBT      REAL       ARRAY                  10603  ARC       REAL       ARRAY
  11373  ARCT      REAL       ARRAY                   1620  ARG       REAL                  COMA
  10343  ARM       REAL       ARRAY                  11133  ARMT      REAL       ARRAY
      4  AS        REAL                 EXTRA        10627  ASC       REAL       ARRAY
  10071  ASCO      REAL                                  7  ASEO      REAL                  EXTRA
  10074  ASD       REAL                                 11  AT        REAL                  GTARG
  10357  AXB       REAL       ARRAY                  11157  AXBT      REAL       ARRAY
  10507  AXC       REAL       ARRAY                  11277  AXCT      REAL       ARRAY
  10247  AXM       REAL       ARRAY                  11037  AXMT      REAL       ARRAY
  10413  AYB       REAL       ARRAY                  11203  AYBT      REAL       ARRAY
  10533  AYC       REAL       ARRAY                  11323  AYCT      REAL       ARRAY
  10273  AYM       REAL       ARRAY                  11063  AYMT      REAL       ARRAY
  10437  AZB       REAL       ARRAY                  11227  AZBT      REAL       ARRAY
  10557  AZC       REAL       ARRAY                  11347  AZCT      REAL       ARRAY
  10317  AZM       REAL       ARRAY                  11107  AZMT      REAL       ARRAY
   1444  A1        REAL                 COMA            64  A1P1      REAL                  COMP
     70  A1P2      REAL                 COMP            74  A1P3      REAL                  COMP
    100  A1P4      REAL                 COMP           104  A1P5      REAL                  COMP
    110  A1P6      REAL                 COMP            63  A2P1      REAL                  COMP
     67  A2P2      REAL                 COMP            73  A2P3      REAL                  COMP
     77  A2P4      REAL                 COMP           103  A2P5      REAL                  COMP
    107  A2P6      REAL                 COMP           102  BDHX      REAL       ARRAY      PK
    130  BDHY      REAL       ARRAY     PK             156  BDHZ      REAL       ARRAY      PK
  10072  BETA      REAL                               1702  CA        REAL                  COMA
   1602  CLA       REAL                 COMA          1605  CLAA      REAL       ARRAY      COMA
      3  CLMB      REAL       ARRAY     COMP            19  BLS1      REAL       ARRAY      COMP
     27  CLS2      REAL       ARRAY     COMP            22  BLY       REAL                  EXTRA
     23  CLZ       REAL                 EXTRA           17  CD        REAL                  EXTRA
      0  COSA      REAL                 COMD             1  COSB      REAL                  COMD
     70  COSE      REAL                 COMA             2  COSG      REAL                  COMD
      3  COSSCO    REAL                 ANG              1  COSSO     REAL                  ANG
   1443  CPL       REAL                 COMA          1441  CTL       REAL                  COMA
     20  CX        REAL                 EXTRA           21  CY        REAL                  EXTRA
     13  C1        REAL                 EXTRA       502160  DAOUT1    REAL
 502171  DAOUT10   REAL                             502172  DAOUT11   REAL
 502161  DAOUT2    REAL                             502162  DAOUT3    REAL
 502163  DAOUT4    REAL                             502164  DAOUT5    REAL
 502165  DAOUT6    REAL                             502166  DAOUT7    REAL
 502167  DAOUT8    REAL                             502170  DAOUT9    REAL
   1160  DELTAR    REAL       ARRAY     COMA          6144  DTR       REAL
      1  DX        REAL                 EXTRA         1261  DXG       REAL                  COMA
   1262  DYG       REAL                 COMA          1263  DZG       REAL                  COMA
   2131  ECOS      REAL       ARRAY     COMA            74  EDOT      REAL                  COMA
   2204  FCI77     REAL       ARRAY     COMA          2173  FI7T      REAL       ARRAY      COMA
      0  FXA       REAL                 GTARG            3  FXB       REAL                  GTARG
      6  FXC       REAL                 GTARG            1  FYA       REAL                  GTARG
      4  FYB       REAL                 GTARG            7  FYC       REAL                  GTARG
      2  FZA       REAL                 GTARG            5  FZB       REAL                  GTARG
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VARIABLES      SN  TYPE            RELOCATION
     10  FZC        REAL                GTARG          1424  F1        REAL                COMA
   1425  F2         REAL                COMA           1426  F3        REAL                COMA
   1254  G          REAL                COMA             73  GAM       REAL                COMA
   1255  GGG        REAL                COMA           1427  G1        REAL                COMA
   1430  G2         REAL                COMA           1431  G3        REAL                COMA
   2152  HR7EE      REAL       ARRAY    COMA          10043  I         INTEGER
 504001  IADIN1     INTEGER                          504012  IADIN10   INTEGER
 504002  IADIN2     INTEGER                          504003  IADIN3    INTEGER
 504004  IADIN4     INTEGER                          504005  IADIN5    INTEGER
 504006  IADIN6     INTEGER                          504007  IADIN7    INTEGER
 504010  IADIN8     INTEGER                          504011  IADIN9    INTEGER
     15  ICN        INTEGER             MISD             60  ICON      INTEGER             COMP
     56  IFT        INTEGER             COMP          10332  III       INTEGER             MANEUV
 514000  IIN        INTEGER                           10042  INL       INTEGER
  10112  INNCL      INTEGER                          516100  IOUT      INTEGER
     57  IPLANE     INTEGER             COMP              1  IPTS      INTEGER             COMA
  10050  IQ01       INTEGER                           10061  IRSS      INTEGER
      0  IS1        INTEGER             COMP          10236  ITAU      INTEGER   ARRAY     MANEUV
  10142  ITRAJ      INTEGER    ARRAY    MANEUV            0  ITT       INTEGER             MANEUV
  10057  IT1        INTEGER                           10066  IV        INTEGER
  10053  I77        INTEGER                               2  I88       INTEGER             COMP
      1  I99        INTEGER             COMP          10100  J         INTEGER
  10054  K          INTEGER                           10056  KA        INTEGER
  10041  KASE       INTEGER                             204  KILL      INTEGER   ARRAY     PK
  10055  KK         INTEGER                               3  KKK       INTEGER             EXTRA
      0  LEVEL      INTEGER             COMA          10102  M         INTEGER
  10333  NADJ       INTEGER             MANEUV         1601  NERR      INTEGER             COMA
  10045  NL         INTEGER                           10045  NLL       INTEGER
  10052  NOGO       INTEGER                           10101  NOK       INTEGER
     14  NOPT       INTEGER             MISD              0  NPTS      INTEGER             EXTRA
   1603  NPX        INTEGER             COMA          10035  NR        REAL
  10044  NRUNS      INTEGER                              41  NSAM      INTEGER             COMP
   1116  NT         INTEGER             COMA          10063  NTAU      INTEGER
   1504  NX         INTEGER             COMA          10077  N111      INTEGER
    232  P          REAL       ARRAY    PK             1617  PHO       REAL                COMA
     77  PPX        REAL       ARRAY    COMA              8  PPXS      REAL      ARRAY     DELT
    161  PPY        REAL       ARRAY    COMA             62  PPYS      REAL      ARRAY     DELT
    243  PPZ        REAL       ARRAY    COMA            144  PPZS      REAL      ARRAY     DELT
   1700  QM         REAL                COMA           1665  QMM       REAL      ARRAY     COMA
     42  Q1         REAL                COMP             43  Q2        REAL                COMP
     44  Q3         REAL                COMP             45  Q4        REAL                COMP
     46  Q5         REAL                COMP             47  Q6        REAL                COMP
     10  R          REAL                EXTRA            72. RI        REAL                COMA
     67  RLB        REAL                COMA           1422  RLBK      REAL                COMA
     11  RM         REAL       ARRAY    MISD          11034  RMT       REAL      ARRAY
     76  RN         REAL                COMA          10725  RR        REAL      ARRAY
   1436  RRR        REAL                COMA           6143  RTD       REAL
   1701  SA         REAL                COMA              6  SC        REAL                EXTRA
  10036  SCALE      REAL                              10040  SCALED    REAL
     11  SCALEE     REAL                EXTRA          1423  SCALEP    REAL                COMA
   1672  SCALET     REAL                COMA           1665  SCALEV    REAL                COMA
  10037  SCALE2     REAL                              10073  SCO       REAL
      5  SEO        REAL                EXTRA             2  SINSCO    REAL                ANG
      0  SINSO      REAL                ANG           10073  SO        REAL
    237  SPHG       REAL                PK              240  SPHS      REAL                PK
    236  SPK        REAL                PK             1440  SPL       REAL                COMA
    241  SPM        REAL                PK               71  SPO       REAL                COMA
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VARIABLES      SN  TYPE          RELOCATION
  1437  SR         REAL                COMA        1442  STL       REAL             COMA
  1435  S1         REAL                COMA          62  S1P1      REAL             COMP
    66  S1P2       REAL                COMP          72  S1P3      REAL             COMP
    76  S1P4       REAL                COMP         102  S1P5      REAL             COMP
   106  S1P6       REAL                COMP        1264  S2        REAL             COMA
    61  S2P1       REAL                COMP          65  S2P2      REAL             COMP
    71  S2P3       REAL                COMP          75  S2P4      REAL             COMP
   101  S2P5       REAL                COMP         105  S2P6      REAL             COMP
  1265  S3         REAL                COMA        1266  S4        REAL             COMA
  1267  S5         REAL                COMA        1122  TAMA      REAL     ARRAY   COMA
 10060  TAU        REAL                             107  THE       REAL             EXTRA
    75  THETAL     REAL                COMA         325  TIME      REAL     ARRAY   COMA
 10060  TIMES      REAL      ARRAY     MANEUV     10211  TM        REAL     ARRAY
  1624  TMA        REAL      ARRAY     COMA         407  TMAS      REAL     ARRAY   COMA
  1623  TREAL      REAL                COMA          24  TRP       REAL             EXTRA
 10051  U77        REAL                           10052  U78       REAL
 10054  U79        REAL                           10055  U80       REAL
  1216  VM         REAL      ARRAY     COMA        1703  VMX       REAL     ARRAY   COMA
   226  VMXS       REAL      ARRAY     DELT        1765  VMY       REAL     ARRAY   COMA
   310  VMYS       REAL      ARRAY     DELT        2047  VMZ       REAL     ARRAY   COMA
   372  VMZS       REAL      ARRAY     DELT          12  VT        REAL             GTARG
  1445  VTI        REAL                COMA          12  VVVV      REAL             EXTRA
    50  W1         REAL                COMP          51  W2        REAL             COMP
    52  W3         REAL                COMP          53  W4        REAL             COMP
    54  W5         REAL                COMP          55  W6        REAL             COMP
 10075  X          REAL                            1432  XC        REAL             COMA
 10105  XCOUX      REAL                           10104  XCOLL     REAL
 10103  XCOMM      REAL                            1117  XCOMP     REAL             COMA
     0  XD         REAL                COMB          12  XDDE      REAL             COMB
     6  XDEF       REAL                COMB           1  XDEM      REAL     ARRAY   MANEUV
     0  XDH        REAL      ARRAY     PK          1270  XDM       REAL     ARRAY   COMA
  1256  XDO        REAL                COMA           3  XDTG      REAL             COMB
  7723  XDTGM      REAL      ARRAY     MANEUV       445  XDTGMS    REAL     ARRAY   COMA
    54  XDTGO      REAL                COMA        1446  XE        REAL     ARRAY   COMA
    14  XLOS       REAL                EXTRA          0  XM        REAL     ARRAY   MISD
   577  XMAN       REAL      ARRAY     COMA        1107  XMISS     REAL     ARRAY   COMA
 11023  XMT        REAL      ARRAY                10055  XPRIME    REAL             MANEUV
  1652  XTA        REAL                COMA           2  XTERM     REAL             EXTRA
    25  XX         REAL      ARRAY     EXTRA          2  XXS       REAL     ARRAY   COMA
 10076  Y          REAL                               3  YA        REAL             COMJ
  1433  YC         REAL                COMA        1120  YCOMP     REAL             COMA
     1  YD         REAL                COMB          13  YDDE      REAL             COMB
     7  YDEF       REAL                COMB        2507  YDEM      REAL     ARRAY   MANEUV
    26  YDH        REAL      ARRAY     PK          1326  YDM       REAL     ARRAY   COMA
  1257  YDO        REAL                COMA           4  YDTG      REAL             COMB
  7761  YDTGM      REAL      ARRAY     MANEUV       503  YDTGMS    REAL     ARRAY   COMA
    65  YDTGO      REAL                COMA        1504  YE        REAL     ARRAY   COMA
    15  YLOS       REAL                EXTRA          3  YM        REAL     ARRAY   MISD
 11026  YMT        REAL      ARRAY                10056  YPRIME    REAL             MANEUV
  1653  YTA        REAL                COMA       10067  Z         REAL
     4  ZA         REAL                COMD        6142  ZABOVE    REAL
  1600  ZALT       REAL                COMA        1434  ZC        REAL             COMA
  1121  ZCOMP      REAL                COMA           2  ZD        REAL             COMB
    14  ZDDE       REAL                COMB          10  ZDEF      REAL             COMB
  5215  ZDEM       REAL      ARRAY     MANEUV        54  ZDH       REAL     ARRAY   PK
  1364  ZDM        REAL      ARRAY     COMA        1260  ZDO       REAL             COMA
     5  ZDTG       REAL                COMB       10017  ZDTGM     REAL     ARRAY   MANEUV
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        PROGRAM MAIN        74774   OPT=1                    FTNH 4.2+75348       01/12/76  14.30.11.      PAGE    15

VARIABLES     SN  TYPE            RELOCATION
   541 , ZDTGMS    REAL       ARRAY    COMA          66  ZDTGO     REAL                COMA
  1542  ZE         REAL       ARRAY    COMA          15  ZLOS      REAL                EXTRA
     6  ZM         REAL       ARRAY    MISO       11031  ZMT       REAL      ARRAY
 10057  ZPRIME     REAL                MANEUV      1664  ZTA       REAL                COMA
 10047  ZTE        REAL                           10113  ZTEO      REAL      ARRAY
    11  ZZZ        REAL                COMB

FILE NAMES        MODE
  4102  HFILE                0 INPUT                   2041  OUTPUT    FMT              0  TAPE5     FMT
  2041  TAPE6

EXTERNALS         TYPE   ARGS
        ASIN       REAL       1 LIBRARY                ATAN2     REAL       2 LIBRARY
        COS        REAL       1 LIBRARY                FLIGHT               0
        GUID                  0                        INIT                 0
        KSCALE                0                        LETH                 0
        MEAN                  9                        MISCOM               0
        PRIME                 0                        QCLIM                0
        SIN        REAL       1 LIBRARY                SQRT      REAL       1 LIBRARY

INLINE FUNCTIONS  TYPE   ARGS
        FLOAT      REAL       1  INTRIN                IFIX      INTEGER    1  INTRIN
        INT        INTEGER    1  INTRIN

STATEMENT LABELS
  4723  3                                    0    5        INACTIVE                0   10         INACTIVE
     0  11                                4645   15                                0   23         INACTIVE
     0  25                                   0   26                             4666   30
     0  31                                   0   40                             4730   41
  5002  42                                5020   50                             5031   51
  5157  52                                5173   53                             5175   54
  5177  55                                5203   56                             5211   60
  5023  62                                   0   63        INACTIVE             7050   77      FMT
  5502  83                                   0   85                                0   90
  5377  91                                   0   95        INACTIVE             7055  102      FMT
  5449  110                               5507  111                             5520  114
  5526  116                                  0  120                                0  121
     0  122                               5676  150                             5762  197
     0  198        INACTIVE               7065  199     FMT                        0  200         INACTIVE
     0  201        INACTIVE               6004  240                             6006  241
  6040  300                               5474  329                             5463  330
     0  331                               7073  332     FMT                     7101  600      FMT  NO REFS
  7132  601     FMT                       6013  602                             7137  605      FMT  NO REFS
     0  609        INACTIVE               7162  620     FMT                     7164  621      FMT
  7156  622     FMT  NO REFS              7205  623     FMT  NO REFS            7232  625      FMT
  6021  626                               6023  627                             4764  628
     0  630                               6031  633                             6026  635
  7236  640     FMT  NO REFS              7255  710     FMT  NO REFS            7267  715      FMT  NO REFS
  7307  720     FMT  NO REFS              7323  725     FMT  NO REFS            7350  800      FMT
  7352  801     FMT  NO REFS              7371  802     FMT                     7377  803      FMT  NO REFS
  7417  805     FMT                       7432  809     FMT                     7436  810      FMT
  7444  811     FMT                       7447  813     FMT                     7456  814      FMT
  7461  815     FMT                       7466  816     FMT                     7472  823      FMT
  7477  830     FMT                       7504  831     FMT                     7511  832      FMT
  7516  833     FMT                       7523  835     FMT                     7540  840      FMT
  7545  902     FMT                       7547  903     FMT                     7552  904      FMT
  7554  907     FMT                       7564  908     FMT                     7570  909      FMT
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STATEMENT LABELS
 7604  912    FMT                   7614  913    FMT                  7624  914    FMT
 7634  915    FMT  NO REFS          7652  916    FMT                  7656  917    FMT
 7661  918    FMT                   7664  919    FMT                  7672  996    FMT
 7674  999    FMT                   7677  2000   FMT                  7701  2001   FMT
 7703  2002   FMT                   7712  2003   FMT                  7722  2004   FMT
 7725  2005   FMT                   7734  2006   FMT                  7747  2007   FMT
 7752  2008   FMT                   7770  2009   FMT  NO REFS         7776  2010   FMT
10001  2011   FMT                  10004  2012   FMT

COMMON BLOCKS   LENGTH
      COMA       1165
      COMB         13
      MANEUV     4316
      GTARG        11
      COMP         73
      EXTRA        72
      ANG           4
      PK          162
      MISO         14
      DELT        300
      COMU          5

STATISTICS
  PROGRAM LENGTH               4657B    2479
  BUFFER LENGTH                4540B    2400
  CM LABELED COMMON LENGTH    13767B    6135
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BEST AVAILABLE COPY

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      BLOCK DATA ONE
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *              XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *              ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      DATA(ITRAJ(I),I=1,59)/3*4,5,3*6,7,8,9,10,11,12,2*13,14,2*15,16,   SERIES 2
     *17,2*13,12,19,20,21,22,23,24,25,21,26,27,28,29,30,31,21,32,33,34, SERIES 2
     *35,36,37,38,39,40,41,39,42,38,43,34,44,5*45/                       SERIES 2
      DATA(ITAU(I),I=1,59)/59*0/                                         SERIES 2
      DATA(XDEM(I,1),I=1,27)/27*0.0/                                     II
      DATA(YDEM(I,1),I=1,27)/27*0.0/
      DATA(ZDEM(I,1),I=1,27)/27*0.0/
      DATA(XDEM(I,2),I=1,27)/27*0.0/                                     JJ
      DATA(YDEM(I,2),I=1,27)/27*168.9/
      DATA(ZDEM(I,2),I=1,27)/27*0.0/
      DATA(XDEM(I,3),I=1,27)/27*0.0/                                     KK
      DATA(YDEM(I,3),I=1,27)/27*337.8/
      DATA(ZDEM(I,3),I=1,27)/27*0.0/
      DATA(XDEM(I,4),I=1,27)/27*0.0/                                     LL
      DATA(YDEM(I,4),I=1,27)/27*506.7/
      DATA(ZDEM(I,4),I=1,27)/27*0.0/
      DATA(XDEM(I,5),I=1,27)/0.,127.9,251.2,365.4,466.4,550.5,614.7,     A
     *656.6,674.8,668.5,638.2,584.7,510.,416.9,308.7,189.4,63.2,-65.3,
     *-191.5,-310.7,-418.7,-511.5,-585.8,-638.9,-668.9,-674.7,-656.1/
      DATA(YDEM(I,5),I=1,27)/675.6,663.4,627.1,568.2,488.8,391.6,280.3,
     *158.8,31.6,-96.7,-221.6,-338.4,-443.,-531.6,-600.9,-648.5,-672.6,
     *-672.4,-647.9,-599.9,-530.2,-441.3,-336.5,-219.5,-94.6,33.8,161.7/
      DATA(ZDEM(I,5),I=1,27)/27*0.0/
      DATA(XDEM(I,6),I=1,27)/27*0.0/                                     MM
      DATA(YDEM(I,6),I=1,27)/27*675.6/
      DATA(ZDEM(I,6),I=1,27)/27*0.0/
      DATA(XDEM(I,7),I=1,27)/0.,-221.1,-417.8,-568.5,-656.6,-672.5,      B
     *-614.2,-488.4,-308.7,-95.1,129.,333.9,511.5,627.7,674.9,647.7,
     *549.2,390.3,188.3,-34.4,-253.2,-444.3,-596.3,-663.9,-668.3,-599.1,
     *-464.7
      DATA(YDEM(I,7),I=1,27)/634.8,599.9,498.9,342.9,149.2,-68.9,-264.3,
     *-444.6,-564.7,-638.6,-683.2,-649.2,-414.7,-234.6,-28.7,180.4,
     *369.7,518.2,609.7,634.,588.5,478.3,315.3,117.7,-92.9,-293.3,
     *-461.4/
      DATA(ZDEM(I,7),I=1,27)/231.1,218.3,131.6,124.8,54.3,-22.2,-96.2,
     *-159.7,-205.4,-228.8,-226.8,-199.9,-151.,-85.4,-10.4,65.7,134.5,
     *188.6,221.9,230.8,214.2,174.1,114.9,42.8,-33.8,-106.8,-167.9/
      DATA(XDEM(I,8),I=1,27)/0.,-127.9,-251.2,-365.4,-466.4,-550.5,      C
     *-614.7,-656.6,-674.8,-668.6,-638.2,-584.7,-510.,-416.9,-308.7,
     *-189.4,-63.2,65.3,191.5,310.7,418.7,511.5,585.8,638.9,668.9,674.7,
     *656.1/
      DATA(YDEM(I,8),I=1,27)/675.6,663.4,627.1,568.2,488.8,391.6,280.3,
     *158.8,31.6,-96.7,-221.6,-338.4,-443.,-531.6,-600.9,-648.5,-672.6,
     *-672.4,-647.9,-599.9,-530.2,-441.3,-336.5,-219.5,-94.6,33.8,161.7/
      DATA(ZDEM(I,8),I=1,27)/27*0.0/
      DATA(XDEM(I,9),I=1,27)/27*0.0/                                     NN
      DATA(YDEM(I,9),I=1,27)/27*634.8/
      DATA(ZDEM(I,9),I=1,27)/27*231.1/
      DATA(XDEM(I,10),I=1,27)/27*0.0/                                    OO
      DATA(YDEM(I,10),I=1,27)/27*714.2/
      DATA(ZDEM(I,10),I=1,27)/27*259.9/
      DATA(XDEM(I,11),I=1,27)/27*0.0/                                    D
      DATA(YDEM(I,11),I=1,27)/844.5,822.5,757.7,653.5,515.4,350.4,167.1,
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      *-24.8,-215.4,-394.9,-553.8,-683.8,-778.3,-832.3,-843.,-809.8,
      *-734.5,-621.,-475.2,-304.6,-118.2,74.4,263.,438.,590.3,711.8,
      *796.2/
       DATA(ZDEM(I,11),I=1,27)/0.,-191.4,-372.8,-534.8,-669.,-768.4,
      *-827.8,-844.1,-816.5,-746.4,-637.6,-495.5,-327.6,-142.7,49.6,
      *239.4,416.6,572.3,698.1,787.6,836.2,841.2,802.4,722.,603.9,454.4,
      *231.3/
       DATA(XDEM(I,12),I=1,27)/27*0.0/                                   Q
       DATA(YDEM(I,12),I=1,27)/815.7,844.,828.4,769.7,670.9,537.3,375.7,
      *194.5,3.2,-188.2,-369.9,-532.3,-667.,-757.,-827.1,-844.2,-817.3,
      *-748.,-639.7,-498.1,-330.6,-145.9,46.4,236.3,413.8,569.9,696.3/
       DATA(ZDEM(I,12),I=1,27)/218.6,28.,-164.,-347.4,-512.8,-651.5,
      *-756.3,-821.8,-844.5,-823.2,-759.2,-655.6,-517.9,-353.3,-170.3,
      *21.6,212.3,392.,551.3,681.9,777.1,831.8,843.2,810.7,736.1,623.2,
      *477.8/
       DATA(XDEM(I,13),I=1,27)/0.,159.9,314.,456.8,583.,688.1,768.4,    E
      *820.8,843.5,835.8,797.8,730.9,637.6,521.2,385.9,236.7,78.9,-81.7,
      *-239.4,-388.4,-523.3,-639.4,-732.2,-798.6,-836.2,-843.4,-820.2/
       DATA(YDEM(I,13),I=1,27)/844.5,829.2,783.9,710.3,610.9,489.5,350.4,
      *198.5,39.5,-120.9,-277.,-423.,-553.8,-664.5,-751.1,-810.6,-840.8,
      *-840.5,-809.8,-749.9,-662.8,-551.7,-420.6,-274.4,-118.2,42.3,
      *201.27
       DATA(ZDEM(I,13),I=1,27)/27*0.0/
       DATA(XDEM(I,14),I=1,27)/0.,-64.3,-128.2,-191.4,-253.4,-314.,      F
      *-372.8,-429.4,-483.5,-534.8,-583.,-627.8,-669.,-706.3,-739.5,
      *-768.4,-792.8,-812.6,-827.8,-838.1,-843.5,-844.1,-839.8,-830.6,
      *-816.5,-797.8,-774.4/
       DATA(YDEM(I,14),I=1,27)7793.5,791.2,784.3,772.9,757.,736.6,712.,
      *683.3,650.6,614.1,574.1,530.7,484.3,435.,383.2,329.2,273.3,215.8,
      *157.,97.4,37.1,-23.3,-83.6,-143.5,-202.5,-260.3,-316.6/
       DATA(ZDEM(I,14),I=1,27)/298.8,288.,285.5,281.3,275.5,268.1,259.2,
      *248.7,236.8,223.5,209.,193.2,176.3,158.3,139.5,119.8,99.5,78.5,
      *57.2,35.4,13.5,-8.5,-30.4,-52.2,-73.7,-94.7,-115.2/
       DATA(XDEM(I,15),I=1,27)/27*0.0/                                   G
       DATA(YDEM(I,15),I=1,27)/844.5,814.6,727.2,588.8,407.8,198.5,-24.8,
      *-246.4,-458.6,-622.9,-751.1,-826.3,-843.0,-800.1,-700.7,-551.7,
      *-363.7,-150.,74.4,293.4,491.7,655.3,772.5,835.1,838.6,782.9,671.8/
       DATA(ZDEM(I,15),I=1,27)/0.,-222.6,-429.4,-605.8,-739.5,-820.8,
      *-844.1,-807.7,-714.2,-570.2,-385.9,-174.3,49.6,270.,471.4,639.4,
      *762.1,831.,841.2,791.9,686.5,532.7,341.1,125.5,-99.,-316.6,-511.7/
       DATA(XDEM(I,16),I=1,27)/0.,64.3,128.2,191.4,253.4,314.,372.8,     H
      *429.4,483.5,534.8,583.,627.8,669.,706.3,739.5,768.4,792.8,812.6,
      *827.8,838.1,843.5,844.1,839.8,830.6,816.5,797.8,774.4/
       DATA(YDEM(I,16),I=1,27)/793.5,791.2,784.3,772.9,757.,736.6,712.,
      *683.3,650.6,614.1,574.1,530.7,484.3,435.,383.2,329.2,273.3,215.8,
      *157.,97.4,37.1,-23.3,-83.6,-143.5,-202.5,-260.3,-316.6/
       DATA(ZDEM(I,16),I=1,27)/288.8,288.,285.5,281.3,275.5,268.1,259.2,
      *248.7,236.8,223.5,209.,193.2,176.3,158.3,139.5,119.8,99.5,78.5,
      *57.2,35.4,13.5,-8.5,-30.4,-52.2,-73.7,-94.7,-115.5/
       DATA(XDEM(I,17),I=1,27)/27*0.0/                                   I
       DATA(YDEM(I,17),I=1,27)/844.5,839.,822.5,795.3,757.7,710.3,653.5,
      *588.3,515.4,435.7,350.4,260.4,167.1,71.6,-24.8,-120.9,-215.5,
      *-307.2,-394.3,-477.4,-553.8,-622.9,-683.3,-735.9,-778.3,-810.6,
      *-832.3/
       DATA(ZDEM(I,17),I=1,27)/0.,-96.3,-191.4,-283.9,-372.8,-456.8,
      *-534.8,-605.8,-659.,-723.4,-768.4,-803.3,-827.8,-841.4,-844.1,
      *-835.8,-816.5,-786.6,-746.5,-696.5,-637.6,-570.2,-495.5,-414.3,
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BLOCK DATA ONE   74/74   OPT=1   FTNH 4.2+75348   01/12/76 14.30.25.   PAGE   3

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      *-327.6,-236.7,-142.7/
       DATA(XDEM(I,18),I=1,27)/0.,-159.9,-314.,-456.8,-583.,-688.1,         J
      *-768.4,-820.8,-843.5,-835.8,-797.8,-730.9,-637.6,-521.2,-385.9,
      *-236.7,-78.9,81.7,239.4,388.4,523.3,639.4,732.2,798.6,836.2,843.4,
      *820.2/
       DATA(YDEM(I,18),I=1,27)/844.5,829.2,783.9,710.3,610.9,489.5,350.4,
      *199.5,39.5,-120.9,-277.,-423.,-553.8,-664.5,-751.1,-810.6,-840.8,
      *-840.5,-809.8,-749.9,-662.8,-551.7,-420.6,-274.4,-118.2,42.3,
      *201.2/
       DATA(ZDEM(I,18),I=1,27)/27*0.0/
       DATA(XDEM(I,19),I=1,27)/0.,128.3,254.1,375.1,488.8,593.2,686.3,      R
      *766.2,831.3,880.5,913.,927.9,925.,904.4,866.4,811.9,741.8,657.5,
      *560.5,452.9,336.5,213.7,86.8,-41.7,-169.5,-294.,-412.9/
       DATA(YDEM(I,19),I=1,27)/872.9,864.5,839.6,798.6,742.3,671.7,588.3,
      *493.6,389.4,277.8,160.9,40.8,-80.,-199.2,-314.7,-424.1,-525.4,
      *-615.6,-696.1,-752.1,-813.6,-849.5,-869.1,-872.,-858.2,-828.,
      *-781.9/
       DATA(ZDEM(I,19),I=1,27)/317.7,314.7,305.6,290.7,270.2,244.5,214.1,
      *179.7,141.7,101.1,58.6,14.9,-29.1,-72.5,-114.5,-154.4,-191.2,
      *-224.4,-253.3,-277.4,-296.1,-309.2,-316.3,-317.4,-312.4,-301.4,
      *-284.6/
       DATA(XDEM(I,20),I=1,27)/0.,-96.3,-191.6,-284.9,-375.1,-461.2,        K
      *-542.3,-617.6,-686.3,-747.5,-800.7,-845.2,-880.6,-906.5,-922.7,
      *-928.8,-925.,-911.2,-887.6,-854.3,-811.9,-760.7,-701.3,-634.3,
      *-560.5,-480.7,-395.6/
       DATA(YDEM(I,20),I=1,27)/928.9,923.9,908.9,884.1,849.8,806.3,754.2,
      *693.8,626.,551.5,471.,385.4,295.6,202.7,107.6,11.3,-85.1,-180.6,
      *-274.1,-364.7,-451.3,-533.1,-609.1,-678.6,-740.7,-794.9,-840.4/
       DATA(ZDEM(I,20),I=1,27)/27*0.0/
       END
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SYMBOLIC REFERENCE MAP (R=1)

VARIABLES       SN  TYPE            RELOCATION
10332  III          INTEGER                 MANEUV         10236  ITAU     INTEGER    ARRAY    MANEUV
10142  ITRAJ        INTEGER        ARRAY    MANEUV             0  ITT      INTEGER             MANEUV
10333  NADJ         INTEGER                 MANEUV         10060  TIMES    REAL       ARRAY    MANEUV
    1  XDEM         REAL           ARRAY    MANEUV          7723  XDTGM    REAL       ARRAY    MANEUV
10055  XPRIME       REAL                    MANEUV          2507  YDEM     REAL       ARRAY    MANEUV
 7751  YDTGM        REAL           ARRAY    MANEUV         10056  YPRIME   REAL                MANEUV
 5215  ZDEM         REAL           ARRAY    MANEUV         10017  ZDTGM    REAL       ARRAY    MANEUV
10057  ZPRIME       REAL                    MANEUV

COMMON BLOCKS   LENGTH
       MANEUV     4316

STATISTICS
  PROGRAM LENGTH                      0B       0
  CM LABELED COMMON LENGTH        10334B    4316
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      BLOCK DATA TWO
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *               XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *               ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      DATA(XDEM(I,21),I=1,27)/27*0.0/                                   S
      DATA(YDEM(I,21),I=1,27)/928.9,901.7,821.8,693.8,525.3,326.,107.6,
     *-117.1,-334.9,-533.1,-700.2,-826.2,-904.,-928.9,-899.4,-817.3,
     *-687.5,-517.4,-317.,-98.1,126.5,343.8,540.9,706.4,830.6,906.1,
     *928.7/
      DATA(ZDEM(I,21),I=1,27)/0.,-223.,-433.,-617.6,-765.2,-869.8,
     *-922.7,-921.5,-866.4,-760.7,-610.5,-424.5,-213.7,9.6,232.3,441.4,
     *624.7,771.5,873.2,923.7,920.3,863.,755.2,603.2,416.,204.4,-19.1/
      DATA(XDEM(I,22),I=1,27)/0.,160.1,315.3,461.2,593.2,707.5,800.7,   T
     *869.8,913.,928.8,916.3,877.5,811.9,722.,610.5,480.7,336.5,182.3,
     *22.6,-137.7,-294.,-441.4,-575.6,-692.7,-789.,-861.6,-908.6/
      DATA(YDEM(I,22),I=1,27)/928.9,915.,873.8,806.3,714.8,601.9,471.,
     *326.,171.2,11.3,-148.9,-304.7,-451.3,-584.5,-700.2,-794.9,-865.8,
     *-910.3,-928.6,-918.6,-881.2,-817.3,-729.,-618.9,-490.3,-347.,
     *-193.4/
      DATA(ZDEM(I,22),I=1,27)/27*0.0/
      DATA(XDEM(I,23),I=1,27)/0.,-96.3,-191.7,-284.9,-375.1,-461.2,     U
     *-542.3,-617.6,-686.3,-747.5,-800.7,-845.2,-880.6,-906.5,-922.7,
     *-928.8,-925.,-911.2,-887.6,-854.3,-811.9,-760.7,-701.3,-634.3,
     *-560.5,-480.7,-395.6/
      DATA(YDEM(I,23),I=1,27)/804.5,800.1,787.2,765.7,736.,698.3,653.1,
     *600.9,542.2,477.6,407.9,333.8,256.,175.6,93.2,9.8,-73.7,-156.4,
     *-237.4,-315.8,-390.9,-461.7,-527.5,-587.7,-641.5,-688.4,-727.8/
      DATA(ZDEM(I,23),I=1,27)/464.5,462.,454.5,442.1,424.9,403.2,377.1,
     *346.9,313.,275.7,235.5,192.7,147.8,101.4,53.8,5.7,-42.5,-90.3,
     *-137.1,-182.3,-225.7,-266.6,-304.6,-339.3,-370.4,-397.4,-420.2/
      DATA(XDEM(I,24),I=1,27)/0.,-223.,-433.,-617.6,-765.2,-869.8,      V
     *-922.7,-921.5,-866.4,-760.7,-610.5,-424.5,-213.7,9.6,232.3,441.4,
     *624.7,771.5,873.2,923.7,920.2,863.,755.2,603.2,416.,204.4,-19.1/
      DATA(YDEM(I,24),I=1,27)/928.9,901.7,821.8,693.8,525.3,326.,107.6,
     *-117.1,-334.9,-533.1,-700.2,-826.2,-904.,-928.9,-899.4,-817.3,
     *-687.4,-517.4,-317.,-98.1,126.5,343.8,540.9,706.4,830.6,906.1,
     *928.7/
      DATA(ZDEM(I,24),I=1,27)/27*0.0/
      DATA(XDEM(I,25),I=1,27)/0.,-191.6,-375.1,-542.3,-686.3,-800.7,    L
     *-880.6,-922.7,-925.,-887.6,-811.9,-701.3,-560.5,-395.6,-213.7,
     *-22.6,169.5,354.3,523.8,670.8,789.,873.2,919.8,925.8,894.,822.6,
     *715.9/
      DATA(YDEM(I,25),I=1,27)/928.9,908.9,849.8,754.2,626.,471.,295.6,
     *107.6,-85.1,-274.1,-451.3,-609.1,-740.7,-840.4,-904.,-928.6,
     *-913.3,-858.7,-767.1,-642.6,-490.3,-315.,-130.,62.5,252.4,431.4,
     *591.3/
      DATA(ZDEM(I,25),I=1,27)/27*0.0/
      DATA(XDEM(I,26),I=1,27)/0.,223.,433.,617.6,766.2,869.8,922.7,     M
     *921.5,866.4,760.7,610.5,424.5,213.7,-9.6,-232.3,-441.4,-624.7,
     *-771.5,-873.2,-923.7,-920.2,-863.,-755.2,-603.2,-416.,-204.4,19.1/
      DATA(YDEM(I,26),I=1,27)/928.9,901.7,821.8,693.8,525.3,326.,107.6,
     *-117.1,-334.9,-533.1,-700.2,-826.2,-904.,-928.9,-899.4,-817.3,
     *-687.4,-517.4,-317.,-98.1,126.5,343.8,540.9,706.4,830.6,906.1,
     *928.7/
      DATA(ZDEM(I,26),I=1,27)/27*0.0/
      DATA(XDEM(I,27),I=1,27)/0.,191.6,375.1,542.3,686.3,800.7,880.6,   N
     *922.7,925.,887.6,811.9,701.3,560.5,395.6,213.7,22.6,-169.5,-354.3,
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     *-523.8,-670.8,-789.,-873.2,-919.8,-926.8,-894.,-822.6,-715.9/
      DATA(YDEM(I,27),I=1,27)/928.9,908.9,849.8,754.2,626.,471.,295.6,
     *107.6,-85.1,-274.1,-451.3,-609.1,-740.7,-840.4,-904.,-928.6,
     *-913.3,-858.7,-767.1,-642.6,-490.3,-317.,-130.,62.5,252.4,
     *431.4,591.9/
      DATA(ZDEM(I,27),I=1,27)/27*0.0/
      DATA(XDEM(I,28),I=1,27)/27*0.0/                                   PP
      DATA(YDEM(I,28),I=1,27)/27*928.9/
      DATA(ZDEM(I,28),I=1,27)/27*0.0/
      DATA(XDEM(I,29),I=1,27)/27*0.0/                                   W
      DATA(YDEM(I,29),I=1,27)/928.9,908.9,849.8,754.2,626.,471.,295.6,
     *107.6,-85.1,-274.1,-451.3,-609.1,-740.7,-840.4,-904.,-928.6,
     *-913.3,-858.7,-767.1,-642.6,-490.3,-317.,-130.,62.5,252.4,431.4,
     *591.9/
      DATA(ZDEM(I,29),I=1,27)/0.,-191.7,-375.1,-542.3,-686.3,-800.7,
     *-880.6,-922.7,-925.,-887.6,-811.9,-701.3,-560.5,-395.6,-213.7,
     *-22.6,169.5,354.3,523.8,670.8,789.,873.2,919.8,926.8,894.,822.6,
     *715.9/
      DATA(XDEM(I,30),I=1,27)/0.,96.3,191.7,284.9,375.1,461.2,542.3,    O
     *617.6,686.3,747.5,800.7,845.2,880.6,906.5,922.7,928.8,925.,911.2,
     *887.6,854.3,811.9,760.7,701.3,634.3,560.5,480.7,395.6/
      DATA(YDEM(I,30),I=1,27)/804.5,800.1,787.2,765.7,736.,698.3,653.1,
     *600.9,542.2,477.6,407.9,333.8,256.,175.5,93.2,9.8,-73.7,-156.4,
     *-237.4,-315.8,-390.9,-461.7,-527.5,-587.7,-641.5,-688.4,-727.8/
      DATA(ZDEM(I,30),I=1,27)/464.5,462.,454.5,442.1,424.9,403.2,377.1,
     *346.9,313.,275.7,235.5,192.7,147.8,101.4,53.8,5.7,-42.5,-90.3,
     *-137.1,-182.3,-225.7,-266.6,-304.6,-339.3,-370.4,-397.4,-420.2/
      DATA(XDEM(I,31),I=1,27)/0.,-160.1,-315.3,-461.2,-593.2,-707.5,    X
     *-800.7,-869.8,-913.,-928.8,-916.9,-877.5,-811.9,-722.,-610.5,
     *-480.7,-336.5,-182.3,-22.6,137.7,294.,441.4,575.6,692.7,789.,
     *861.6,908.6/
      DATA(YDEM(I,31),I=1,27)/928.9,915.,873.8,806.3,714.8,601.9,471.,
     *326.,171.2,11.3,-148.9,-304.7,-451.3,-584.5,-700.2,-794.9,-865.8,
     *-910.8,-928.6,-918.5,-881.2,-817.3,-729.,-618.9,-490.3,-347.,
     *-193.4/
      DATA(ZDEM(I,31),I=1,27)/27*0.0/
      DATA(XDEM(I,32),I=1,27)/0.,-128.3,-254.1,-375.1,-488.8,-593.2,    Y
     *-686.3,-766.2,-831.3,-880.6,-913.,-927.9,-925.,-904.4,-866.4,
     *-811.9,-741.8,-657.5,-560.5,-452.9,-336.5,-213.7,-86.8,41.7,169.5,
     *294.,412.9/
      DATA(YDEM(I,32),I=1,27)/872.9,864.5,839.6,798.6,742.3,671.7,588.3,
     *493.6,389.4,277.8,160.9,40.8,-80.,-199.2,-314.7,-424.1,-525.4,
     *-616.6,-696.1,-762.1,-813.6,-849.5,-869.1,-872.,-858.2,828.,-781.9/
      DATA(ZDEM(I,32),I=1,27)/317.7,314.7,305.6,290.7,270.2,244.5,214.1,
     *179.7,141.7,101.1,58.6,14.9,-29.1,-72.5,-114.5,-154.4,-191.2,
     *-224.4,-253.3,-277.4,-296.1,-309.2,-316.3,-317.4,-312.4,-301.4,
     *-284.6/
      DATA(XDEM(I,33),I=1,27)/27*0.0/                                   P
      DATA(YDEM(I,33),I=1,27)/1013.4,1011.3,1005.2,995.,980.9,962.7,
     *940.7,914.9,885.4,852.3,815.8,776.,733.1,687.3,638.6,587.4,533.8,
     *478.1,420.4,361.1,300.3,238.2,175.2,111.6,47.4,-16.9,-81.2/
      DATA(ZDEM(I,33),I=1,27)/0.,-64.3,-128.4,-191.9,-254.9,-316.4,
     *-376.8,-435.7,-492.9,-548.1,-601.1,-651.7,-699.6,-744.7,-786.8,
     *-825.8,-861.4,-893.5,-922.,-946.9,-967.9,-985.,-998.1,-1007.2,
     *-1012.3,-1013.2,-1010.1/
      DATA(XDEM(I,34),I=1,27)/27*0.0/                                   QQ
      DATA(YDEM(I,34),I=1,27)/27*978.8/
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      DATA(ZDEM(I,34),I=1,27)/27*262.3/
      DATA(XDEM(I,35),I=1,27)/27*0.0/                              Z
      DATA(YDEM(I,35),I=1,27)/1013.4,988.4,914.9,796.3,538.6,449.5,
     *238.2,15.3,-208.5,-421.9,-614.6,-777.1,-901.4,-981.3,-1012.9,
     *-994.7,-927.6,-814.9,-662.,-476.6,-267.8,-45.8,178.5,394.,590.1,
     *757.2,887./
      DATA(ZDEM(I,35),I=1,27)/0.,-223.4,-435.7,-626.7,-786.8,-908.2,
     *-985.,-1013.2,-991.7,-921.4,-805.7,-650.4,-463.1,-253.,-30.5,
     *193.5,408.,602.4,767.2,894.3,977.3,1012.3,997.5,933.6,823.8,
     *673.5,490./
      DATA(XDEM(I,36),I=1,27)/27*0.0/                              AA
      DATA(YDEM(I,36),I=1,27)/1013.4,1008.8,995.,972.3,940.7,900.6,
     *852.3,796.3,733.1,663.3,587.4,506.2,420.4,330.8,238.2,143.5,
     *47.4,-49.1,-145.1,-239.8,-332.4,-421.9,-507.6,-588.7,-664.5,
     *-734.3,-797.4/
      DATA(ZDEM(I,36),I=1,27)/0.,-96.4,-191.9,-285.6,-376.8,-464.6,
     *-548.1,-626.7,-699.6,-766.1,-825.8,-877.9,-922.,-957.8,-985.,
     *-1003.2,-1012.3,-1012.2,-1002.9,-984.6,-957.3,-921.4,-877.,-824.8,
     *-765.1,-698.4,-625.4/
      DATA(XDEM(I,37),I=1,27)/0.,128.4,254.6,376.8,492.9,601.1,699.6,  BB
     *786.3,861.4,922.,967.9,998.1,1012.2,1010.1,991.7,957.3,907.5,
     *843.1,765.1,674.7,573.5,463.1,345.2,221.8,94.7,-33.8,-161.8/
      DATA(YDEM(I,37),I=1,27)/1013.4,1005.2,980.8,940.7,885.4,815.8,
     *733.1,633.6,533.8,420.4,300.2,175.2,47.4,-81.2,-208.4,-332.4,
     *-451.,-562.3,-664.5,-756.1,-835.4,-901.4,-952.8,-988.8,-1008.9,
     *-1012.8,-1000.4/
      DATA(ZDEM(I,37),I=1,27)/27*0.0/
      DATA(XDEM(I,38),I=1,27)/27*0.0/                              CC
      DATA(YDEM(I,38),I=1,27)/1013.4,995.,940.7,852.3,733.1,587.4,420.4,
     *238.2,47.4,-145.1,-332.4,-507.6,-664.5,-797.4,-901.4,-972.7,
     *-1008.9,-1008.6,-971.8,-899.8,-795.3,-662.,-504.8,-329.3,-141.8,
     *50.7,241.4/
      DATA(ZDEM(I,38),I=1,27)/0.,-191.9,-376.8,-548.1,-599.6,-825.8,
     *-922.,-985.,-1012.3,-1002.9,-957.3,-877.,-765.1,-625.4,-463.1,
     *-284.1,-94.7,98.,287.2,466.,628.,767.2,878.7,958.4,1003.4,1012.1,
     *984.2/
      DATA(XDEM(I,39),I=1,27)/27*0.0/                              RR
      DATA(YDEM(I,39),I=1,27)/27*1013.4/
      DATA(ZDEM(I,39),I=1,27)/27*0.0/
      DATA(XDEM(I,40),I=1,27)/0.,-64.3,-128.4,-191.9,-254.6,-316.4,    DD
     *-376.8,-435.7,-492.9,-548.1,-601.1,-651.7,-699.6,-744.7,-786.8,
     *-825.8,-861.4,-893.5,-922.,-946.9,-967.9,-985.,-998.1,-1007.2,
     *-1012.3,-1013.2,-1010.1/
      DATA(YDEM(I,40),I=1,27)/877.6,875.8,870.5,861.7,849.4,833.7,814.7,
     *792.3,766.8,738.1,706.5,672.1,643.9,595.2,553.1,508.7,462.3,414.,
     *364.1,312.7,260.,206.3,151.8,96.6,41.1,-14.6,-70.3/
      DATA(ZDEM(I,40),I=1,27)/506.7,505.7,502.6,497.5,490.4,481.4,470.4,
     *457.4,442.7,426.2,407.9,388.,366.6,343.6,319.3,293.7,266.9,239.,
     *210.2,180.5,150.1,119.1,87.6,55.8,23.7,-8.5,-40.6/
      DATA(XDEM(I,41),I=1,27)/0.,64.3,128.4,191.9,254.6,316.4,376.8,   EE
     *435.7,492.9,548.1,601.1,651.7,699.6,744.7,786.8,825.8,861.4,893.5,
     *922.,946.9,967.9,985.,998.1,1007.2,1012.3,1013.2,1010.1/
      DATA(YDEM(I,41),I=1,27)/877.6,875.8,870.5,861.7,849.4,833.7,814.7,
     *792.3,756.8,738.1,706.5,672.1,634.9,595.2,553.1,508.7,462.3,414.,
     *364.1,312.7,260.,206.3,151.8,96.6,41.1,-14.6,-70.3/
      DATA(ZDEM(I,41),I=1,27)/506.7,505.7,502.6,497.5,490.4,481.4,470.4,
     *457.4,442.7,426.2,407.9,388.,366.6,343.6,319.3,293.7,266.9,239.,
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     *210.2,180.5,150.1,119.1,87.6,55.8,23.7,-8.5,-40.6/
      END
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         BLOCK DATA TRO         74/74    OPT=1                            FTNH 4.2+75348      01/12/76  14.30.35.        PAGE      ?

         SYMBOLIC REFERENCE MAP (R=1)

VARIABLES        SN  TYPE               RELOCATION
   10332  III        INTEGER                 MANEUV        10236  ITAU       INTEGER      ARRAY      MANEUV
   10142  ITRAJ      INTEGER     ARRAY       MANEUV            0  ITT        INTEGER                 MANEUV
   10333  NADJ       INTEGER                 MANEUV        10060  TIMES      REAL         ARRAY      MANEUV
       1  XDEM       REAL        ARRAY       MANEUV         7723  XDTGM      REAL         ARRAY      MANEUV
   10055  XPRIME     REAL                    MANEUV         2507  YDEM       REAL         ARRAY      MANEUV
    7761  YDTGM      REAL        ARRAY       MANEUV        10056  YPRIME     REAL                    MANEUV
    5215  ZDEM       REAL        ARRAY       MANEUV        10017  ZDTGM      REAL         ARRAY      MANEUV
   10057  ZPRIME     REAL                    MANEUV

COMMON BLOCKS    LENGTH
         MANEUV     4316

STATISTICS
  PROGRAM LENGTH                    0B        0
  CM LABELED COMMON LENGTH      10334B     4316
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      BLOCK DATA THREE
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                PPX(50),PPY(50),PPZ(50),TIME(50),THAS(30),XDTGMS(30)
     *               ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *               ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/PK/XDH(22),YDH(22),ZDH(22),BDHX(22),BDHY(22),BDHZ(22)
     *,KILL(22),P(4),SPK,SPHG,SPHS,SPM
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *               XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *              ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      DATA(XDEM(I,42),I=1,27)/0.,-160.2,-316.4,-464.6,-601.1,-722.5,      FF
     *-825.8,-908.2,-967.9,-1003.2,-1013.2,-997.8,-957.3,-892.7,-805.7,
     *-698.4,-573.5,-434.2,-284.0,-126.7,33.8,193.5,348.3,494.4,628.,
     *745.8,844.9/
      DATA(YDEM(I,42),I=1,27)/1013.4,1000.6,962.7,900.6,815.8,710.6,
     *587.4,449.5,300.2,143.5,-16.9,-176.9,-332.4,-479.5,-614.6,-734.3,
     *-835.4,-915.6,972.7,-1005.4,-1012.8,-994.7,-951.6,-884.6,-795.3,
     *-686.,-559.5/
      DATA(ZDEM(I,42),I=1,27)/27*0.0/
      DATA(XDEM(I,43),I=1,27)/0.,191.9,376.8,548.1,699.6,825.8,922.,985.  GG
     *,1012.3,1002.9,957.3,877.,765.1,625.4,453.1,284.1,94.7,-98.,-287.2
     *,-466.,-628.,-767.2,-878.7,-958.4,-1003.4,-1012.1,-984.2/
      DATA(YDEM(I,43),I=1,27)/978.8,961.1,908.6,823.3,708.1,567.4,406.1,
     *230.1,45.8,-140.2,-321.1,-490.3,-641.9,-770.2,-870.6,-939.6,-974.5
     *,-974.2,-938.7,-869.2,-768.2,-639.5,-487.6,-318.,-137.,49.,233.2/
      DATA(ZDEM(I,43),I=1,27)/262.3,257.5,243.5,220.6,189.7,152.,108.8,
     *61.7,12.3,-37.6,-86.,-131.4,-172.,-206.4,-233.3,-251.8,-261.1,
     *-261.,-251.5,-232.9,-209.8,-171.3,-130.6,-89.2,-36.7,13.1,62.5/
      DATA(XDEM(I,44),I=1,27)/27*0.0/                                     HH
      DATA(YDEM(I,44),I=1,27)/952.3,1005.2,1008.8,962.7,869.2,733.,
     *560.7,360.9,143.3,-81.4,-302.,-507.8,-683.6,-835.5,-941.4,-1000.9,
     *-1011.2,-971.8,-884.5,-753.7,-585.9,-389.2,-173.4,50.9,272.7,
     *481.2,665.9/
      DATA(ZDEM(I,44),I=1,27)/346.6,128.2,-96.6,-316.5,-520.9,-699.7,
     *-844.1,-946.9,-1003.2,-1010.1,-967.3,-877.,-743.5,-573.4,-375.1,
     *-158.4,66.1,287.4,494.5,677.3,826.8,935.6,998.4,1012.1,976.,891.9,
     *763.9/
      DATA(XDEM(I,45),I=1,27)/27*0.0/                                     SS
      DATA(YDEM(I,45),I=1,27)/27*1124.8/
      DATA(ZDEM(I,45),I=1,27)/27*0.0/
      DATA   (CLAA(I),I=1,8)/0.043,0.0435,0.0455,0.0485,0.0515,0.059,
     *        0.0477,0.033/
      DATA   (QMM(I),I=1,8)/0.0,0.3,0.6,0.8,0.9,1.05,1.5,2.2/
      DATA(TAMA(I),I=1,28)/0.,.25,1.,1.7,2.,2.5,3.,4.,4.5,5.,6.,7.,
     *     7.5,8.,9.,9.5,10.,11.,11.5,12.,13.,14.,15.,16.,17.,18.,19.,
     *     20./
      DATA(DELTAR(I),I=1,28)/0.,31.2,445.6,1418.6,1978.1,2958.1,3945.6,
     *     5870.6,6805.6,7728.1,9558.1,11368.1,12263.,13115.,14580.,
     *     15198.,15738.,16753.,17218.,17660.,18505.,19295.,20038.,
     *     20745.,21420.,22060.,22665.,23240./
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      DATA(VM(I),I=1,28)/125.,125.,980.,1800.,1930.,1990.,1960.,1890.,
     *      1850.,1840.,1820.,1800.,1780.,1630.,1300.,1130.,1070.,960.,
     *      900.,870.,820.,760.,725.,690.,560.,620.,590.,560./
      DATA (XDH(I),I=1,22)/13.5,0.,9.,-11.3,-16.8,-13.2,-1.5,-4.2,-16.3,
     *-18.2,-20.3,-6.8,-19.4,-19.4,-19.8,3.4,-1.6,-5.6,-1.6,-16.7,-12.2,
     *-16.3/
      DATA (YDH(I),I=1,22)/12*0.,-4.,4.,0.,0.,.9,0.,-.9,3*0./
      DATA (ZDH(I),I=1,22)/.1,.2,.6,0.,3.8,2.8,-.3,-.3,.3,.4,5.7,-.3,.3,
     *.3,0.,-1.6,-1.6,-1.6,-1.6,-.2,-1.9,-.1/
      DATA (BDHX(I),I=1,22)/6.5,12.5,6.,5.5,2.7,2.8,6.8,3.,1.8,1.5,2.5,
     *2.5,2.2,2.2,.2,1.3,1.3,1.3,1.3,3.1,3.6,2./
      DATA (BDHY(I),I=1,22)/1.7,2.,1.3,2.,.3,.4,7.5,9.5,3.2,.3,.1,11.9,
     *2.2,2.2,1.,1.6,.6,1.6,.5,1.9,.3,2.1/
      DATA (BDHZ(I),I=1,22)/2.,2.5,2.8,2.3,2.7,1.6,.3,.3,.2,2.3,2.3,.2,
     *.1,.1,1.,.9,.6,.9,.6,1.9,1.4,2.1/
      DATA (KILL(I),I=1,22)/4*1,0,1,0,0,1,5*0,1,5*0,1,1/
      DATA (ECOS(I),I=1,17)/-1.,-.9848,-.9397,-.866,-.7071,-.5,-.342,
     *-.1736,0.0,.1736,.5,.7071,.866,.9397,.9848,.9962,1./
      DATA (HR7EE(I),I=1,17)/5.3568E-10,6.4385E-10,5.7854E-10,3.7351E-10
     *,1.7936E-10,6.8327E-11,4.0449E-11,2.8362E-11,2.0376E-11,2.027E-11,
     *1.8443E-11,1.568E-11,1.184E-11,8.7428E-12,5.2709E-12,3.4869E-12,1.
     *8586E-12/
      DATA(FI7T(I),I=1,9)/.18,.332,.612,.737,.833,.92,.97,.99999,1.0000/
      DATA (FCI77(I),I=1,9)/0.0,10.741,32.223
     *,42.964,53.705,64.446,75.187,80.555,
     *100.0/
      END
```

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      BLOCK DATA THREE        74/74    OPT=1                         FTNH 4.2+75348      01/12/76  14.30.40.        PAGE    3

      SYMBOLIC REFERENCE MAP (R=1)

VARIABLES      SN  TYPE            RELOCATION
   1621  AAA       REAL                 COMA          1620  ARG       REAL                COMA
   1444  A1        REAL                 COMA           102  BDHX      REAL       ARRAY    PK
    130  BDHY      REAL      ARRAY      PK             156  BDHZ      REAL       ARRAY    PK
   1702  CA        REAL                 COMA          1602  CLA       REAL                COMA
   1605  CLAA      REAL      ARRAY      COMA            70  COSE      REAL                COMA
   1443  CPL       REAL                 COMA          1441  CTL       REAL                COMA
   1150  DELTAR    REAL      ARRAY      COMA          1261  DXG       REAL                COMA
   1262  DYG       REAL                 COMA          1263  DZG       REAL                COMA
   2131  ECOS      REAL      ARRAY      COMA            74  EDOT      REAL                COMA
   2204  FCI77     REAL      ARRAY      COMA          2173  FI7T      REAL       ARRAY    COMA
   1424  F1        REAL                 COMA          1425  F2        REAL                COMA
   1426  F3        REAL                 COMA          1254  G         REAL                COMA
     73  GAM       REAL                 COMA          1255  GGG       REAL                COMA
   1427  G1        REAL                 COMA          1430  G2        REAL                COMA
   1431  G3        REAL                 COMA          2152  HR7EE     REAL       ARRAY    COMA
  10332  III       INTEGER              MANEUV           1  IPTS      INTEGER             COMA
  10235  ITAJ      INTEGER   ARRAY      MANEUV       10142  ITRAJ     INTEGER    ARRAY    MANEUV
      0  ITT       INTEGER              MANEUV         204  KILL      INTEGER    ARRAY    PK
      0  LEVEL     INTEGER              COMA         10333  NADJ      INTEGER             MANEUV
   1601  NERR      INTEGER              COMA          1603  NPX       INTEGER             COMA
   1116  NT        INTEGER              COMA          1604  NX        INTEGER             COMA
    232  P         REAL      ARRAY      PK            1617  PHO       REAL                COMA
     77  PPX       REAL      ARRAY      COMA           161  PPY       REAL       ARRAY    COMA
    243  PPZ       REAL      ARRAY      COMA          1700  QM        REAL                COMA
   1655  QMM       REAL      ARRAY      COMA            72  RI        REAL                COMA
     57  RLB       REAL                 COMA          1422  RLBK      REAL                COMA
     76  RN        REAL                 COMA          1435  RRR       REAL                COMA
   1701  SA        REAL                 COMA          1423  SCALEP    REAL                COMA
   1622  SCALET    REAL                 COMA          1665  SCALEV    REAL                COMA
    237  SPHG      REAL                 PK             249  SPHS      REAL                PK
    236  SPK       REAL                 PK            1440  SPL       REAL                COMA
    241  SPM       REAL                 PK              71  SPO       REAL                COMA
   1437  SR        REAL                 COMA          1442  STL       REAL                COMA
   1435  S1        REAL                 COMA          1264  S2        REAL                COMA
   1265  S3        REAL                 COMA          1266  S4        REAL                COMA
   1257  S5        REAL                 COMA          1122  TAMA      REAL       ARRAY    COMA
     75  THETAL    REAL                 COMA           325  TIME      REAL       ARRAY    COMA
  10050  TIMES     REAL      ARRAY      MANEUV        1624  TMA       REAL       ARRAY    COMA
    407  TMAS      REAL      ARRAY      COMA          1623  TREAL     REAL                COMA
   1216  VM        REAL      ARRAY      COMA          1703  VMX       REAL       ARRAY    COMA
   1765  VMY       REAL      ARRAY      COMA          2047  VMZ       REAL       ARRAY    COMA
   1445  VTI       REAL                 COMA          1432  XC        REAL                COMA
   1117  XCOMP     REAL                 COMA             1  XDEM      REAL       ARRAY    MANEUV
      0  XDH       REAL      ARRAY      PK            1270  XDM       REAL       ARRAY    COMA
   1256  XDO       REAL                 COMA          7723  XDTGM     REAL       ARRAY    MANEUV
    445  XDTGMS    REAL      ARRAY      COMA            64  XDTGO     REAL                COMA
   1446  XE        REAL      ARRAY      COMA           577  XMAN      REAL       ARRAY    COMA
   1107  XMISS     REAL      ARRAY      COMA         10055  XPRIME    REAL                MANEUV
   1652  XTA       REAL                 COMA             2  XXS       REAL       ARRAY    COMA
   1433  YC        REAL                 COMA          1120  YCOMP     REAL                COMA
   2537  YDEM      REAL      ARRAY      MANEUV          26  YDH       REAL       ARRAY    PK
   1326  YDM       REAL      ARRAY      COMA          1257  YDO       REAL                COMA
   7751  YDTGM     REAL      ARRAY      MANEUV         503  YDTGMS    REAL       ARRAY    COMA
     55  YDTGO     REAL                 COMA          1504  YE        REAL       ARRAY    COMA
```

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VARIABLES     SN  TYPE          RELOCATION
 10056  YPRIME    REAL              MANEUV        1663  YTA      REAL               COMA
  1600  ZALT      REAL              COMA          1434  ZC       REAL               COMA
  1121  ZCOMP     REAL              COMA          5215  ZDEM     REAL      ARRAY    MANEUV
    54  ZDH       REAL      ARRAY   PK            1364  ZDM      REAL      ARRAY    COMA
  1250  ZDD       REAL              COMA         10017  ZDTGM    REAL      ARRAY    MANEUV
   541  ZDTGMS    REAL      ARRAY   COMA            66  ZDTGO    REAL               COMA
  1542  ZE        REAL      ARRAY   COMA         10057  ZPRIME   REAL               MANEUV
  1664  ZTA       REAL              COMA

COMMON BLOCKS   LENGTH
        COMA      1165
        PK         152
        MANEUV    4316

STATISTICS
  PROGRAM LENGTH                 0B        0
  CM LABELED COMMON LENGTH   13013B     5643
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      SUBROUTINE INIT
      COMMON/EXTRA/NPTS,DX,XTERM,KKK,AS,SEO,SC,ASEO,R,SCALEL,VVVV,C1,
     *XLCS,YLOS,ZLOS,CO,CX,CY,CLY,CLZ,TRP,XX(50),THE
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDYGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *           PPX(50),PPY(50),PPZ(50),TIME(50),THAS(30),XDTGMS(30)
     *          ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *          ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VH(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,SI,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
     *,XDDE,YDDE,ZDDE
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P5,A2P6,A1P6
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *           XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *          ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      COMMON/GTARG/FXA,FYA,FZA,FXB,FYB,FZB,FXC,FYC,FZC,AT,VT
      DATA  RTD,DTR/57.2957795,0.01745329/
C*** GENERATE THE DISTANCE TABLE FOR COLLECTING DATA POINTS
      SCALEP=20.*(102.375)/(1.+GGG)
      STPN=NPTS
      DIF=(XTERM+(STPN-1.)*DX)-((20.*100.)/
     1(1.+GGG))
      IF(DIF.GE.0.) GO TO 47
      NADJ=NPTS
      GO TO 48
   47 ARG=DIF/DX
      NADJ=NPTS-IFIX(ARG)-1
   48 CONTINUE
      DO 20 I=1,NADJ
      INDEX=NADJ-I+1
      XI = I - 1
      XX(INDEX) = XTERM + (XI*DX)
      XXS(INDEX)=-XX(INDEX)
   20 CONTINUE
C*** WRITE OUT RANGE TABLE
      IF(IS1.NE.1) PRINT 820, NPTS,DX,XTERM
      IF(IS1.EQ.1) GO TO 21
      PRINT 800
      PRINT 700
      PRINT 800
      PRINT 705
      PRINT 300
      PRINT 822, (XX(I),XXS(I),I=1,NADJ)
      PRINT 800
   21 CONTINUE
      XD=XDM(1)
      YD=YDM(1)
      ZD=ZDM(1)
      XDX=XD
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      YDY=YD
      ZDZ=ZD
      CALL GUID
      XDTGO=XDTG
      YDTGO=YDTG
      ZDTGO=ZDTG
      PRINT 806,XD,YD,ZD,XDTG,YDTG,ZDTG
      ARG = SQRT (XD**2 + YD**2)
      IF(KKK.EQ.1) GO TO 65
      SEO = ATAN2 (ZD,ARG)
   65 SC=AS*DTR
      ASEO = SEO * RTD
      IF(ITT.NE.1) PRINT 807,AS,ASEO
C*** SCALE INITIAL LAUNCH CONDITIONS
      RFEET = RI
      RI=R
      GAM=G
C*** TRANSFORM MANEUVER VECTORS TO LAUNCH COORDINATES AND SCALE THEM
      IF(IS1.EQ.1) GO TO 66
      PRINT 800
      PRINT 910
      PRINT 800
      PRINT 907
   66 CONTINUE
      DO 70 I = 1,NT
      XD=XDM(I)
      YD=YDM(I)
      ZD=ZDM(I)
      CALL GUID
      XDTGM(I) = XDTG
      YDTGM(I) = YDTG
      ZDTGM(I) = ZDTG
      XDTGMS(I)=XDTGM(I)
      YDTGMS(I)=YDTGM(I)
      ZDTGMS(I)=ZDTGM(I)
      IF(IS1.NE.1) PRINT 908, THA(I),XDM(I),YDM(I),ZDM(I)
   70 CONTINUE
      XD=XDX
      YD=YDY
      ZD=ZDZ
      IF(IS1.EQ.1) GO TO 76
      PRINT 911
      PRINT 800
      PRINT 907
      PRINT 800
      DO 75 I=1,NT
      PRINT 908, THA(I),XDTGM(I),YDTGM(I),ZDTGM(I)
   75 CONTINUE
   76 CONTINUE
C     CALCULATE INITIAL TARGET ANGLE OF ATTACK
      AAA=1116.89+0.003894*ZZZ
      ARG=0.00003*ZZZ
      PHO=0.00237692*EXP(ARG)
      QM=VVVV/AAA
      NPX=2
      NX=8
      CALL INTERP (QM,QMM,CLAA,NX,NPX,CLA,NERR)
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      SUBROUTINE INIT         74/74    OPT=1                        FTNH 4.2+75348        01/12/76  14.30.45.        PAGE     3

      WT=13500.0
      ST=248.0
      XEU=XE(1)
      YEU=YE(1)
      ZEU=ZE(1)
      AT=2.*WT*SQRT(XEU**2+YEU**2+ZEU**2)/(PHO*(VVVV**2)*ST*CLA*32.174)
      AT=AT*DTR
C     CALCULATE INITIAL COSE
      C1=COS(AT)
      S1=SIN(AT)
      S9=SQRT(XD*XD+YD*YD)
      COSE=(STL*(ZD*C1-S9*S1)-(C1+(ZD*S1/S9))*(XD*S2+YD*S4))/VVVV
      E111 = COSE
      CO=COSE**2
C     CALCULATE INITIAL APPARENT PLUME LENGTH-TO-BREADTH RATIO
      PLB=RLBR*SQRT(1.-CO)
C     CALCULATE INITIAL LOS
      XLOS=-R*S2
      YLOS=-R*S4
      ZLOS=R*STL
C     CALCULATE HORIZON REFERENCE VECTOR
      ARG=YLOS/SQRT(XLOS**2+YLOS**2)
      BET=ACOS(ARG)
      IF(XLOS.LT.0.0) CY=-SIN(BET)
      IF(XLOS.GE.0.0) CY=SIN(BET)
      CX=-COS(BET)
C     CALCULATE INITIAL TARGET CENTERLINE UNIT VECTOR
      CLX=XD*(C1+ZD*S1/SQRT(XD*XD+YD*YD))/
     1VVVV
      CLY=YD*(C1+ZD*S1/SQRT(XD*XD+YD*YD))/
     1VVVV
      CLZ=(ZD*C1-SQRT(XD*XD+YD*YD)*S1)/VVVV
C     CALCULATE INITIAL PLUME ROTATION ANGLE
      ARG1=(YLOS*CLZ-ZLOS*CLY)*CX+(ZLOS*CLX-XLOS*CLZ)*CY
      ARG2=SQRT((YLOS*CLZ-ZLOS*CLY)**2+(ZLOS*CLX-XLOS*CLZ)**2
     *+(XLOS*CLY-YLOS*CLX)**2)
      ARG=ARG1/ARG2
      THE=ACOS(ARG)
      ARG=XLOS*CLY-YLOS*CLX
      IF(ARG.LT.0.0) GO TO 80
      IF(THE.LE.1.570796326) GO TO 85
      TRP=THE-4.71238898
      GO TO 90
   80 TRP=1.570796326-THE
      GO TO 90
   85 TRP=1.570796326+THE
   90 SPO=TRP
      NX=17
      NPX=2
      CALL INTERP(E111,ECOS,HR7EE,NX,NPX,HR7E,NERR)
      HC7FT=1209.675*HR7E*EXP(-2.341*ALOG(RFEET/22965.831))
      P1IRSS=2.*ATAN(.5/RLB)
      P2IRSS=22.5*RLB/RFEET
      AT7   =((P2IRSS**2)*SIN(P1IRSS))/(2.0*(COS(P1IRSS/2.0))**2)
      PJTU1=0.1*EXP(1.003258*ALOG(AT7))
      FI7=HC7FT/PJTU1
      NX=9
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```
      NPX=2
      CALL INTERP (FI7,FI7T,FCI77,NX,NPX,FCI7,NERR)
      RN=FCI7
  700 FORMAT(10X,33H RANGE-TO-GO TABLE FOR DATA COLLECTION)
  705 FORMAT(22X,9H RANGE,FT,5X,13H SCALED RANGE)
  800 FORMAT (1H0)
  806 FORMAT(10X,8H XDTEO =F10.2,7H FT/SEC,5X,8H YDTEO =F10.2,7H FT/SEC,
     *5X,8H ZDTEO =F10.2,7H FT/SEC,/10X,9H XDTLO =F10.2,7H FT/SEC,5X,
     *8H YDTLO =F10.2,7H FT/SEC,5X,8H ZDTLO =F10.2,7H FT/SEC)
  807 FORMAT(10X,17H CROSSING ANGLE =F7.2,4H DEG,5X,13H DIVE ANGLE =
     *F7.2,4H DEG)
  820 FORMAT(10X,7H NPTS =I3,4X,5H DX =F6.2,3H FT,4X,8H XTERM =F7.2,
     *3H FT)
  822 FORMAT (20X F10.2,5X E15.8)
  907 FORMAT (1H0 4X 35H TIME     XD MANEUVER     YD MANEUVER
     *                     15H     ZD MANEUVER)
  908 FORMAT(1X F10.4, 3(3X F8.2,4X))
  910 FORMAT(10X,24H EARTH FIXED COORDINATES)
  911 FORMAT(10X,19H LAUNCH COORDINATES)
  912 FORMAT(9E14.8)
      RETURN
      END
```

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SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
1 INIT

VARIABLES SN TYPE RELOCATION

SN	VARIABLE	TYPE		RELOCATION	SN	VARIABLE	TYPE		RELOCATION
1621	AAA	REAL		COMA	1620	ARG	REAL		COMA
1021	ARG1	REAL			1022	ARG2	REAL		
4	AS	REAL		EXTRA	7	ASEO	REAL		EXTRA
11	AT	REAL		GTARG	1027	AT7	REAL		
1444	A1	REAL		COMA	64	A1P1	REAL		COMP
70	A1P2	REAL		COMP	74	A1P3	REAL		COMP
100	A1P4	REAL		COMP	104	A1P5	REAL		COMP
110	A1P6	REAL		COMP	63	A2P1	REAL		COMP
67	A2P2	REAL		COMP	73	A2P3	REAL		COMP
77	A2P4	REAL		COMP	103	A2P5	REAL		COMP
107	A2P6	REAL		COMP	1017	BET	REAL		
1702	CA	REAL		COMA	1602	CLA	REAL		COMA
1605	CLAA	REAL	ARRAY	COMA	3	CLMS	REAL	ARRAY	COMP
15	CLS1	REAL	ARRAY	COMP	27	CLS2	REAL	ARRAY	COMP
1020	CLX	REAL			22	CLY	REAL		EXTRA
23	CLZ	REAL		EXTRA	17	CO	REAL		EXTRA
70	COSE	REAL		COMA	1443	CPL	REAL		COMA
1441	CTL	REAL		COMA	20	CX	REAL		EXTRA
21	CY	REAL		EXTRA	13	C1	REAL		EXTRA
1150	DELTAR	REAL	ARRAY	COMA	1000	DIF	REAL		
515	DTR	REAL			1	DX	REAL		EXTRA
1251	DXG	REAL		COMA	1262	DYG	REAL		COMA
1263	DZG	REAL		COMA	2131	ECOS	REAL	ARRAY	COMA
74	EDOT	REAL		COMA	1016	E111	REAL		
1032	FCI7	REAL			2204	FCI77	REAL	ARRAY	COMA
1031	FI7	REAL			2173	FI7T	REAL	ARRAY	COMA
0	FXA	REAL		GTARG	3	FXB	REAL		GTARG
6	FXC	REAL		GTARG	1	FYA	REAL		GTARG
4	FY9	REAL		GTARG	7	FYB	REAL		GTARG
2	FZA	REAL		GTARG	5	FZB	REAL		GTARG
10	FZC	REAL		GTARG	1424	F1	REAL		COMA
1425	F2	REAL		COMA	1426	F3	REAL		COMA
1254	G	REAL		COMA	73	GAM	REAL		COMA
1255	GGG	REAL		COMA	1427	G1	REAL		COMA
1430	G2	REAL		COMA	1431	G3	REAL		COMA
1024	HC7FT	REAL			1023	HR7E	REAL		
2152	HR7EE	REAL	ARRAY	COMA	1001	I	INTEGER		
60	ICCN	INTEGER		COMP	56	IFT	INTEGER		COMP
10332	III	INTEGER		MANEUV	1002	INDEX	INTEGER		
57	IPLANE	INTEGER		COMP	1	IPTS	INTEGER		COMA
0	IS1	INTEGER		COMP	10236	ITAU	INTEGER	ARRAY	MANEUV
10142	ITRAJ	INTEGER	ARRAY	MANEUV	0	ITT	INTEGER		MANEUV
2	I88	INTEGER		COMP	1	I99	INTEGER		COMP
3	KKK	INTEGER		EXTRA	0	LEVEL	INTEGER		COMA
10333	NADJ	INTEGER		MANEUV	1601	NERR	INTEGER		COMA
0	NPTS	INTEGER		EXTRA	1603	NPX	INTEGER		COMA
41	NSAM	INTEGER		COMP	1116	NT	INTEGER		COMA
1604	NX	INTEGER		COMA	1617	PHO	REAL		COMA
1030	PJTU1	REAL			77	PPX	REAL	ARRAY	COMA
151	PPY	REAL	ARRAY	COMA	243	PPZ	REAL	ARRAY	COMA
1025	P1IRSS	REAL			1026	P2IRSS	REAL		

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VARIABLES SN		TYPE		RELOCATION					
1700	QM	REAL		COMA	1666	QMM	REAL	ARRAY	COMA
42	Q1	REAL		COMP	43	Q2	REAL		COMP
44	Q3	REAL		COMP	45	Q4	REAL		COMP
46	Q5	REAL		COMP	47	Q6	REAL		COMP
10	R	REAL		EXTRA	1007	RFEET	REAL		
72	RI	REAL		COMA	67	RLB	REAL		COMA
1422	RLOK	REAL		COMA	76	RN	REAL		COMA
1436	RRR	REAL		COMA	514	RTD	REAL		
1701	SA	REAL		COMA	6	SC	REAL		EXTRA
11	SCALEL	REAL		EXTRA	1423	SCALEP	REAL		COMA
1622	SCALET	REAL		COMA	1665	SCALEV	REAL		COMA
5	SEJ	REAL		EXTRA	1440	SPL	REAL		COMA
71	SPD	REAL		COMA	1437	SR	REAL		COMA
1011	ST	REAL			1442	STL	REAL		COMA
777	STPN	REAL			1435	S1	REAL		COMA
62	S1P1	REAL		COMP	66	S1P2	REAL		COMP
72	S1P3	REAL		COMP	76	S1P4	REAL		COMP
102	S1P5	REAL		COMP	106	S1P6	REAL		COMP
1264	S2	REAL		COMA	61	S2P1	REAL		COMP
55	S2P2	REAL		COMP	71	S2P3	REAL		COMP
75	S2P4	REAL		COMP	101	S2P5	REAL		COMP
105	S2P6	REAL		COMP	1265	S3	REAL		COMA
1266	S4	REAL		COMA	1267	S5	REAL		COMA
1015	S9	REAL			1122	TAMA	REAL	ARRAY	COMA
107	THE	REAL		EXTRA	75	THETAL	REAL		COMA
325	TIME	REAL	ARRAY	COMA	10060	TIMES	REAL	ARRAY	MANEUV
1624	TMA	REAL	ARRAY	COMA	407	TMAS	REAL	ARRAY	COMA
1623	TREAL	REAL		COMA	24	TRP	REAL		EXTRA
1216	VM	REAL	ARRAY	COMA	1703	VMX	REAL	ARRAY	COMA
1755	VMY	REAL	ARRAY	COMA	2047	VMZ	REAL	ARRAY	COMA
12	VT	REAL		GTARG	1445	VTI	REAL		COMA
12	VVVV	REAL		EXTRA	1010	WT	REAL		
50	W1	REAL		COMP	51	W2	REAL		COMP
52	W3	REAL		COMP	53	W4	REAL		COMP
54	W5	REAL		COMP	55	W6	REAL		COMP
1432	XC	REAL		COMA	1117	XCOMP	REAL		COMA
0	XD	REAL		COMB	12	XDDE	REAL		COMB
6	XDEF	REAL		COMB	1	XDEM	REAL	ARRAY	MANEUV
1270	XDM	REAL	ARRAY	COMA	1256	XDO	REAL		COMA
3	XDTG	REAL		COMB	7723	XDTGM	REAL	ARRAY	MANEUV
445	XDTGMS	REAL	ARRAY	COMA	64	XDTGO	REAL		COMA
1004	XDX	REAL			1446	XE	REAL	ARRAY	COMA
1012	XEU	REAL			1003	XI	REAL		
14	XLOS	REAL		EXTRA	577	XMAN	REAL	ARRAY	COMA
1107	XMISS	REAL	ARRAY	COMA	10055	XPRIME	REAL		MANEUV
1662	XTA	REAL		COMA	2	XTERM	REAL		EXTRA
25	XX	REAL	ARRAY	EXTRA	2	XXS	REAL	ARRAY	COMA
1433	YC	REAL		COMA	1120	YCOMP	REAL		COMA
1	YD	REAL		COMB	13	YDDE	REAL		COMB
7	YDEF	REAL		COMB	2507	YDEM	REAL	ARRAY	MANEUV
1326	YDM	REAL	ARRAY	COMA	1257	YDO	REAL		COMA
4	YDTG	REAL		COMB	7761	YDTGM	REAL	ARRAY	MANEUV
503	YDTGMS	REAL	ARRAY	COMA	65	YDTGO	REAL		COMA
1005	YDY	REAL			1504	YE	REAL	ARRAY	COMA
1013	YEU	REAL			15	YLOS	REAL		EXTRA
10056	YPRIME	REAL		MANEUV	1663	YTA	REAL		COMA
1600	ZALT	REAL		COMA	1434	ZC	REAL		COMA

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VARIABLES       SN  TYPE            RELOCATION
   1121  ZCOMP      REAL                  COMA          2  ZD        REAL                COMB
     14  ZODE       REAL                  COMB         10  ZDEF      REAL                COMB
   5215  ZDEM       REAL       ARRAY      MANEUV     1364  ZDM       REAL      ARRAY     COMA
   1260  ZOO        REAL                  COMA          5  ZDTG      REAL                COMB
  10017  ZOTGM      REAL       ARRAY      MANEUV      541  ZDTGMS    REAL      ARRAY     COMA
     66  ZOTGO      REAL                  COMA       1006  ZOZ       REAL
   1542  ZE         REAL       ARRAY      COMA       1014  ZEU       REAL
     16  ZLOS       REAL                  EXTRA     10057  ZPRIME    REAL                MANEUV
   1654  ZTA        REAL                  COMA         11  ZZZ       REAL                COMB

FILE NAMES          MODE
         OUTPUT     FMT

EXTERNALS           TYPE    ARGS
         ACOS       REAL     1 LIBRARY                   ALOG      REAL      1 LIBRARY
         ATAN       REAL     1 LIBRARY                   ATAN2     REAL      2 LIBRARY
         COS        REAL     1 LIBRARY                   EXP       REAL      1 LIBRARY
         GUID                0                           INTERP              7
         SIN        REAL     1 LIBRARY                   SQRT      REAL      1 LIBRARY

INLINE FUNCTIONS    TYPE    ARGS
         IFIX       INTEGER  1  INTRIN

STATEMENT LABELS
      0  20                             73   21                                 16   47
     22  48                            120   65                                144   66
      0  70                              0   75                                230   76
    411  80                            414   85                                416   90
    641  700    FMT                    647   705    FMT                        654   800    FMT
    656  306    FMT                    700   807    FMT                        710   820    FMT
    717  822    FMT                    722   907    FMT                        732   908    FMT
    736  910    FMT                    743   911    FMT                        747   912    FMT  NO REFS

COMMON BLOCKS    LENGTH
         EXTRA       72
         COMA      1165
         COMB        13
         COMP        73
         MANEUV    4316
         GTARG       11

STATISTICS
  PROGRAM LENGTH                 1033B      539
  CM LABELED COMMON LENGTH      13022B     5650
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```
      SUBROUTINE LETH
      COMMON/PK/XDH(22),YDH(22),ZDH(22),BDHX(22),BDHY(22),BDHZ(22)
     *,KILL(22),P(4),SPK,SPHG,SPHS,SPM
      COMMON/MISD/XM(3),YM(3),ZM(3),RM(3),NOPT,ICN
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *             XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *             ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      COMMON/DELT/PPXS(50),PPYS(50),PPZS(50),VMXS(50),VMYS(50),VMZS(50)
      COMMON/GTARG/FXA,FYA,FZA,FXB,FYB,FZB,FXC,FYC,FZC,AT,VT
      COMMON/COMD/COSA,COSB,COSG,YA,ZA
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
      COSA=(1./ZA)/SQRT((1./ZA)**2+(YA/ZA)**2+1.)
      COSB=(YA/ZA)/SQRT((1./ZA)**2+(YA/ZA)**2+1.)
      COSG=1./SQRT((1./ZA)**2+(YA/ZA)**2+1.)
      SSX=0.0
      SSY=0.0
      SSZ=0.0
      DO 4 J=1,NADJ
      SSX=SSX+VMXS(J)
      SSY=SSY+VMYS(J)
      SSZ=SSZ+VMZS(J)
    4 CONTINUE
      ADJ=FLOAT(NADJ)
C***  AVERAGE LAUNCH COORDINATES OF RELATIVE VELOCITY VECTORS OVER DATA
C     COLLECTION RANGE
      COOL5=(SSX/ADJ)
      COOL6=(SSY/ADJ)
      COOL7=(SSZ/ADJ)
C***  GENERALIZED TARGET COORDINATES OF AVERAGE RELATIVE VELOCITY VECTOR
C     REFERENCED TO ORIGIN AT TAILPIPE
      CUUL5=FXA*COOL5+FYA*COOL6+FZA*COOL7
      CUUL6=FXB*COOL5+FYB*COOL6+FZB*COOL7
      CUUL7=FXC*COOL5+FYC*COOL6+FZC*COOL7
      C1=COS(AT)
      S1=SIN(AT)
C***  TARGET FIXED COORDINATES OF AVERAGE RELATIVE VELOCITY VECTOR
C     REFERENCED TO ORIGIN AT TAILPIPE
      CARL5=CUUL7*C1+CUUL5*S1
      CARL6=-CUUL6
      CARL7=CUUL5*C1-CUUL7*S1
C***  TARGET FIXED COORDINATES OF AVERAGE INERTIAL MISSILE VELOCITY
C     VECTOR
C     REFERENCED TO ORIGIN AT TAILPIPE
      VM1=(CUUL7+VT)*C1+CUUL5*S1
      VM2=-CUUL6
      VM3=CUUL5*C1-(CUUL7+VT)*S1
C***  GENERALIZED TARGET COORDINATES OF POSITION VECTOR OF LAST DATA
C     POINT
C     REFERENCED TO ORIGIN AT TAILPIPE
      XAI=FXA*PPXS(NADJ)+FYA*PPYS(NADJ)+FZA*PPZS(NADJ)
      ZAI=FXC*PPXS(NADJ)+FYC*PPYS(NADJ)+FZC*PPZS(NADJ)
      YAI=FXB*PPXS(NADJ)+FYB*PPYS(NADJ)+FZB*PPZS(NADJ)
C***  TARGET FIXED COORDINATES OF POSITION VECTOR OF LAST DATA POINT
C     REFERENCED TO ORIGIN AT TAILPIPE
```

```
      XAIMD=ZAI*C1+XAI*S1
      YAIMD=-YAI
      ZAIMD=XAI*C1-ZAI*S1
C***  DISTANCE BETWEEN LAST DATA POINT AND XF-YF PLANE PIERCING POINT
C     REFERENCED TO ORIGIN AT TAILPIPE
      D1=SQRT((XAIMD+ZM(1)/ZA)**2+(YAIMD-YM(1)+(YA/ZA)*ZM(1))**2
     *+ZAIMD**2)
C***  COMPONENTS OF UNIT VECTOR IN DIRECTION FROM XF-YF PLANE PIERCING
C     POINT TO POSITION OF LAST DATA POINT
C     REFERENCED TO ORIGIN AT TAILPIPE
      AA=(XAIMD+ZM(1)/ZA)/D1
      BB=(YAIMD-YM(1)+(YA/ZA)*ZM(1))/D1
      CC=ZAIMD/D1
      IF(COSA/ABS(COSA).NE.AA/ABS(AA)) COSA=-COSA
      IF(COSB/ABS(COSB).NE.BB/ABS(BB)) COSB=-COSB
      IF(COSG/ABS(COSG).NE.CC/ABS(CC)) COSG=-COSG
C***  COSINE OF THETA
      COST=AA*COSA+BB*COSB+CC*COSG
C***  DISTANCE BETWEEN PK MODEL AIM POINT AND XF-YF PLANE PIERCING POINT
C     REFERENCED TO ORIGIN AT TAILPIPE
      D2=D1*COST
C***  TARGET FIXED COORDINATES OF PK MODEL AIM POINT
C     REFERENCED TO ORIGIN AT CG
      XAIM=D2*COSA-ZM(1)/ZA-19.5
      YAIM=D2*COSB+YM(1)-(YA/ZA)*ZM(1)
      ZAIM=D2*COSG
      IF(IS1.EQ.1) GO TO 300
      PRINT 999,XAIMD,YAIMD,ZAIMD,D1,AA,BB,CC,COST,D2
      PRINT 999,COSA,COSB,COSG
  300 CONTINUE
      NELIPS=22
      VSHELL=SQRT(VM1**2+VM2**2+VM3**2)
      BUX=VM1/VSHELL
      BUY=VM2/VSHELL
      BUZ=VM3/VSHELL
      IF(IS1.EQ.1) GO TO 301
      PRINT 999,COOL5,COOL6,COOL7,CUUL5,CUUL6,CUUL7,C1,S1
      PRINT 999,CARL5,CARL6,CARL7,VM1,VM2,VM3,XAI,YAI,ZAI
      PRINT 999,XAIM,YAIM,ZAIM,VSHELL,BUX,BUY,BUZ
  301 CONTINUE
      TSTAB=100.
      MPEN=0
      DO 444 M=1,NELIPS
      CAY1=(XAIM-XDH(M))/BDHX(M)
      CAY3=(YAIM-YDH(M))/BDHY(M)
      CAY5=(ZAIM-ZDH(M))/BDHZ(M)
      CAY2=CARL5/BDHX(M)
      CAY4=CARL6/BDHY(M)
      CAY6=CARL7/BDHZ(M)
      CAY7=CAY2**2+CAY4**2+CAY6**2
      CAY8=2.*(CAY1*CAY2+CAY3*CAY4+CAY5*CAY6)
      CAY9=CAY1**2+CAY3**2+CAY5**2-1.
      TEMP1=(CAY8*0.5)/CAY7
      TEMP2=CAY9/CAY7
      DISCRI=TEMP1**2-TEMP2
      IF(DISCRI)444,445,445
  445 TTRIAL=-TEMP1-SQRT(DISCRI)
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```
      IF(TRIAL-TSTAB)446,444,444
  446 TSTAB=TTRIAL
      MPEN=M
  444 CONTINUE
      DO 460 M=1,4
  460 P(M)=0.
      IF(MPEN)461,461,462
  461 P(1)=1.
      GO TO 500
  462 IF(KILL(MPEN))471,471,472
  471 P(2)=1.
      GO TO 500
  472 TTT=TSTAB
      M=MPEN
      XS=XAIM+CARL5*TTT
      YS=YAIM+CARL6*TTT
      ZS=ZAIM+CARL7*TTT
      AN=2.*(XS-XDH(M))/(BDHX(M)**2)
      BN=2.*(YS-YDH(M))/(BDHY(M)**2)
      CN=2.*(ZS-ZDH(M))/(BDHZ(M)**2)
      CSANG=(-AN*BUX-BN*BUY-CN*BUZ)/SQRT(AN**2+BN**2+CN**2)
      IF(CSANG-.174)481,481,482
  481 P(3)=1.
      GO TO 500
  482 P(4)=1.
  500 CONTINUE
      PRINT 101, P(1),P(2),P(3),P(4)
      SPK=SPK+P(4)
      SPHG=SPHG+P(3)
      SPHS=SPHS+P(2)
      SPM=SPM+P(1)
  101 FORMAT(1H0,7H       =,F6.4,3X,13H             =,F6.4,3X,16H
     *      =,F6.4,3X,7H       =,F6.4)
  999 FORMAT(10(1X,E11.4))
      RETURN
      END
```

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SUBROUTINE LETH      74/74    OPT=1                         FTNH 4.2+75348      01/12/76  14.30.55.      PAGE     4

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1 LETH

VARIABLES        SN  TYPE            RELOCATION
  552  AA            REAL                              524  ADJ       REAL
  613  AN            REAL                               11  AT        REAL                GTARG
   64  A1P1          REAL                  COMP         70  A1P2      REAL                COMP
   74  A1P3          REAL                  COMP        100  A1P4      REAL                COMP
  104  A1P5          REAL                  COMP        110  A1P6      REAL                COMP
   63  A2P1          REAL                  COMP         67  A2P2      REAL                COMP
   73  A2P3          REAL                  COMP         77  A2P4      REAL                COMP
  103  A2P5          REAL                  COMP        107  A2P6      REAL                COMP
  553  BB            REAL                              102  BDHX      REAL       ARRAY    PK
  130  BDHY          REAL      ARRAY       PK          156  BDHZ      REAL       ARRAY    PK
  614  BN            REAL                              564  BUX       REAL
  565  BUY           REAL                              566  BUZ       REAL
  535  CARL5         REAL                              536  CARL6     REAL
  537  CARL7         REAL                              572  CAY1      REAL
  575  CAY2          REAL                              573  CAY3      REAL
  576  CAY4          REAL                              574  CAY5      REAL
  577  CAY6          REAL                              600  CAY7      REAL
  601  CAY8          REAL                              602  CAY9      REAL
  554  CC            REAL                                3  CLMS      REAL       ARRAY    COMP
   15  CLS1          REAL      ARRAY       COMP         27  CLS2      REAL       ARRAY    COMP
  615  CN            REAL                              525  COOL5     REAL
  526  COOL6         REAL                              527  COOL7     REAL
    0  COSA          REAL                  COMD          1  COSB      REAL                COMD
    2  COSS          REAL                  COMD        555  COST      REAL
  616  CSANG         REAL                              530  CUUL5     REAL
  531  CUUL6         REAL                              532  CUUL7     REAL
  533  C1            REAL                              605  DISCRI    REAL
  551  D1            REAL                              556  D2        REAL
    0  FXA           REAL                  GTARG         3  FXB       REAL                GTARG
    6  FXC           REAL                  GTARG         1  FYA       REAL                GTARG
    4  FYB           REAL                  GTARG         7  FYC       REAL                GTARG
    2  FZA           REAL                  GTARG         5  FZB       REAL                GTARG
   10  FZC           REAL                  GTARG        15  ICN       INTEGER             MISD
   50  ICON          INTEGER               COMP         56  IFT       INTEGER             COMP
10332  III           INTEGER               MANEUV       57  IPLANE    INTEGER             COMP
    0  IS1           INTEGER               COMP      10236  ITAU      INTEGER    ARRAY    MANEUV
10142  ITRAJ         INTEGER   ARRAY       MANEUV        0  ITT       INTEGER             MANEUV
    2  I88           INTEGER               COMP          1  I99       INTEGER             COMP
  523  J             INTEGER                           204  KILL      INTEGER    ARRAY    PK
  571  M             INTEGER                           570  MPEN      INTEGER
10333  NADJ          INTEGER               MANEUV      562  NELIPS    INTEGER
   14  NOPT          INTEGER               MISD         41  NSAM      INTEGER             COMP
  232  P             REAL      ARRAY       PK            0  PPXS      REAL       ARRAY    DELT
   62  PPYS          REAL      ARRAY       DELT        144  PPZS      REAL       ARRAY    DELT
   42  Q1            REAL                  COMP         43  Q2        REAL                COMP
   44  Q3            REAL                  COMP         45  Q4        REAL                COMP
   46  Q5            REAL                  COMP         47  Q6        REAL                COMP
   11  RM            REAL      ARRAY       MISD        237  SPHG      REAL                PK
  240  SPMS          REAL                  PK          236  SPK       REAL                PK
  241  SPM           REAL                  PK          520  SSX       REAL
  521  SSY           REAL                              522  SSZ       REAL
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          SUBROUTINE LETH        74/74   OPT=1                          FTNH 4.2+75348       01/12/76  14.30.55.       PAGE     5

VARIABLES        SN  TYPE           RELOCATION
     534  S1         REAL                                62  S1P1       REAL              COMP
      56  S1P2       REAL                COMP            72  S1P3       REAL              COMP
      76  S1P4       REAL                COMP           102  S1P5       REAL              COMP
     106  S1P6       REAL                COMP            61  S2P1       REAL              COMP
      65  S2P2       REAL                COMP            71  S2P3       REAL              COMP
      75  S2P4       REAL                COMP           101  S2P5       REAL              COMP
     105  S2P6       REAL                COMP           603  TEMP1      REAL
     604  TEMP2      REAL                             10060  TIMES      REAL     ARRAY    MANEUV
     557  TSTAB      REAL                               606  TTRIAL     REAL
     607  TTT        REAL                               226  VMXS       REAL     ARRAY    DELT
     310  VMYS       REAL       ARRAY    DELT           372  VMZS       REAL     ARRAY    DELT
     540  VM1        REAL                               541  VM2        REAL
     542  VM3        REAL                               563  VSHELL     REAL
      12  VT         REAL                STARG           50  W1         REAL              COMP
      51  W2         REAL                COMP            52  W3         REAL              COMP
      53  W4         REAL                COMP            54  W5         REAL              COMP
      55  W6         REAL                COMP           543  XAI        REAL
     557  XAIM       REAL                               546  XAIMD      REAL
       1  XDEM       REAL       ARRAY    MANEUV           0  XDH        REAL     ARRAY    PK
    7723  XDTGM      REAL       ARRAY    MANEUV           0  XM         REAL     ARRAY    MISD
   10055  XPRIME     REAL                MANEUV         610  XS         REAL
       3  YA         REAL                COMD           545  YAI        REAL
     550  YAIM       REAL                               547  YAIMD      REAL
    2507  YDEM       REAL       ARRAY    MANEUV          26  YDH        REAL     ARRAY    PK
    7751  YDTGM      REAL       ARRAY    MANEUV           3  YM         REAL     ARRAY    MISD
   10055  YPRIME     REAL                MANEUV         611  YS         REAL
       4  Z4         REAL                COMD           544  ZAI        REAL
     561  ZAIM       REAL                               550  ZAIMD      REAL
    5215  ZDEM       REAL       ARRAY    MANEUV          54  ZDH        REAL     ARRAY    PK
   10017  ZDTGM      REAL       ARRAY    MANEUV           6  ZM         REAL     ARRAY    MISD
   10057  ZPRIME     REAL                MANEUV         612  ZS         REAL

FILE NAMES        MODE
          OUTPUT    FMT

EXTERNALS         TYPE    ARGS
          COS       REAL      1 LIBRARY                     SIN        REAL     1 LIBRARY
          SQRT      REAL      1 LIBRARY

INLINE FUNCTIONS    TYPE    ARGS
          ABS       REAL      1  INTRIN                     FLOAT      REAL     1  INTRIN

STATEMENT LABELS
       0  4                                 475  101     FMT                215  300
     236  301                               306  444                          0  445          INACTIVE
       0  446          INACTIVE               0  460                          0  461          INACTIVE
     317  462                                 0  471       INACTIVE         324  472
       0  481          INACTIVE             367  482                        371  500
     507  999       FMT

COMMON BLOCKS    LENGTH
          PK          152
          MISD         14
          MANEUV     4316
          DELT        300
          STARG        11
          COMD          5
```

```
      SUBROUTINE LETH        74/74    OPT=1                          FTNH 4.2+75348      01/12/76  14.30.55.        PAGE     6

  COMMON BLOCKS    LENGTH
       COMP            73

  STATISTICS
    PROGRAM LENGTH               617B      399
    CM LABELED COMMON LENGTH  114218      4881
```

```
      SUBROUTINE QCLIM
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
C     CALCULATE CONTROL LIMITS
      S2P1=W1*CLS2(NSAM)
      S1P1=W1*CLS1(NSAM)
      A2P1=Q1+W1*CLMS(NSAM)
      A1P1=Q1-W1*CLMS(NSAM)
      S2P2=W2*CLS2(NSAM)
      S1P2=W2*CLS1(NSAM)
      A2P2=Q2+W2*CLMS(NSAM)
      A1P2=Q2-W2*CLMS(NSAM)
      S2P3=W3*CLS2(NSAM)
      S1P3=W3*CLS1(NSAM)
      A2P3=Q3+W3*CLMS(NSAM)
      A1P3=Q3-W3*CLMS(NSAM)
      S2P4=W4*CLS2(NSAM)
      S1P4=W4*CLS1(NSAM)
      A2P4=Q4+W4*CLMS(NSAM)
      A1P4=Q4-W4*CLMS(NSAM)
      S2P5=W5*CLS2(NSAM)
      S1P5=W5*CLS1(NSAM)
      A2P5=Q5+W5*CLMS(NSAM)
      A1P5=Q5-W5*CLMS(NSAM)
      S2P6=W6*CLS2(NSAM)
      S1P6=W6*CLS1(NSAM)
      A2P6=Q6+W6*CLMS(NSAM)
      A1P6=Q6-W6*CLMS(NSAM)
      RETURN
      END
```

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```
      SUBROUTINE QCLIM       74/74    OPT=1                     FTNH 4.2+75348       01/12/76  14.31.02.       PAGE     2

      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1   QCLIM

VARIABLES       SN  TYPE            RELOCATION
   64   A1P1        REAL                  COMP         70   A1P2        REAL                  COMP
   74   A1P3        REAL                  COMP        100   A1P4        REAL                  COMP
  104   A1P5        REAL                  COMP        110   A1P6        REAL                  COMP
   63   A2P1        REAL                  COMP         67   A2P2        REAL                  COMP
   73   A2P3        REAL                  COMP         77   A2P4        REAL                  COMP
  103   A2P5        REAL                  COMP        107   A2P6        REAL                  COMP
    3   CLMS        REAL         ARRAY    COMP         15   CLS1        REAL         ARRAY    COMP
   27   CLS2        REAL         ARRAY    COMP         60   ICON        INTEGER              COMP
   56   IFT         INTEGER               COMP         57   IPLANE      INTEGER              COMP
    0   IS1         INTEGER               COMP          2   I88         INTEGER              COMP
    1   I99         INTEGER               COMP        41-   NSAM        INTEGER              COMP
   42   Q1          REAL                  COMP         43   Q2          REAL                  COMP
   44   Q3          REAL                  COMP         45   Q4          REAL                  COMP
   46   Q5          REAL                  COMP         47   Q6          REAL                  COMP
   62   S1P1        REAL                  COMP         66   S1P2        REAL                  COMP
   72   S1P3        REAL                  COMP         76   S1P4        REAL                  COMP
  102   S1P5        REAL                  COMP        106   S1P6        REAL                  COMP
   61   S2P1        REAL                  COMP         65   S2P2        REAL                  COMP
   71   S2P3        REAL                  COMP         75   S2P4        REAL                  COMP
  101   S2P5        REAL                  COMP        105   S2P6        REAL                  COMP
   50   W1          REAL                  COMP         51   W2          REAL                  COMP
   52   W3          REAL                  COMP         53   W4          REAL                  COMP
   54   W5          REAL                  COMP         55   W6          REAL                  COMP

COMMON BLOCKS   LENGTH
      COMP          73

STATISTICS
  PROGRAM LENGTH                 56B       46
  CM LABELED COMMON LENGTH      111B       73
```

```
      SUBROUTINE GUID
C** THIS SUBROUTINE TRANSFORMS EARTH FIXED TO LAUNCH COORDINATES.
      COMMON /ANG/SINSO,COSSO,SINSCO,COSSCO
      COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
     *,XDDE,YDDE,ZDDE
C***
      XDTG = XD * COSSO * COSSCO + YD*COSSO*SINSCO - ZD*SINSO
      YDTG = -XD*SINSCO + YD*COSSCO
      ZDTG = XD*SINSO*COSSCO + YD*SINSO*SINSCO + ZD*COSSO
C***
      RETURN
      END
```

```
SUBROUTINE GUID       74/74   OPT=1                    FTNH 4.2+75348     01/12/76  14.31.06.      PAGE     2

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
  1  GUID

VARIABLES      SN  TYPE          RELOCATION
  3  COSSCO     REAL                ANG              1  COSSO     REAL            ANG
  2  SINSCO     REAL                ANG              0  SINSO     REAL            ANG
  0  XD         REAL                COMB            12  XDDE      REAL            COMB
  6  XDEF       REAL                COMB             3  XDTG      REAL            COMB
  1  YD         REAL                COMB            13  YDDE      REAL            COMB
  7  YDEF       REAL                COMB             4  YDTG      REAL            COMB
  2  ZD         REAL                COMB            14  ZDDE      REAL            COMB
 10  ZDEF       REAL                COMB             5  ZDTG      REAL            COMB
 11  ZZZ        REAL                COMB

COMMON BLOCKS   LENGTH
    ANG              4
    COMB            13

STATISTICS
  PROGRAM LENGTH                21B       17
  CM LABELED COMMON LENGTH      21B       17
```

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```
      SUBROUTINE KSCALE,RETURNS(Z1)
C*** THIS ROUTINE GIVES THE ESTIMATED TIME AT 1000 FT-TO-GO (T-PRIME)
C*** AND THE VALUE OF GAMMA THAT WILL NOT ALLOW ANALOG OVERLOAD (GAMA).
C*** THEY DETERMINE THE VARIABLE SCALE FACTOR EQUATION. THE RETURNED
C*** VALUES ARE G FOR T-PRIME AND GGG FOR GAMA.
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                    PPX(50),PPY(50),PPZ(50),TIME(50),THAS(30),XDTGMS(30)
     *                   ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *                   ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,H1,H2,H3,H4,H5,H6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
C
C
C*** BEGIN CONVERGING SEARCH FOR T-PRIME AT 1000 FT-TO-GO.
C
      R=RI
      DG=1.
      AN=0.
      G=0.
   10 G=G+DG
      ARG1=G*SQRT(YDTGO**2+ZDTGO**2)
      ARG2=R+G*XDTGO-1000.
      THETA2=ATAN2(ARG1,ARG2)
      NPX=2
      IF (G.GT.20.) GO TO 20
      NB=29
      CALL INTERP(G,TAMA,DELTAR,NB,NPX,DR,NERR)
      VALUE=R-DR*COS(THETA2)+G*XDTGO-1000.
      A=ABS(VALUE)
      IF (A.LT.20.) GO TO 40
      IF (VALUE.GT.0.) GO TO 10
      AN=AN+1.
      G=G-DG
      DG=.1/AN
      GO TO 10
   20 PRINT 30
   30 FORMAT(10X,35H T-PRIME IS GREATER THAN 20 SECONDS)
      RETURN Z1
   40 CONTINUE
      IF(IS1.NE.1) PRINT 50,G,DR
   50 FORMAT(10X,10H T-PRIME =F10.4,4H SEC,5X,26H DELTAR AT 1000 FT TO G
     *O =F10.2,3H FT)
C
C
C*** BEGIN CONVERGING SEARCH FOR GAMA.
C
      DG=1.
      AN=0.
```

```
      GG=0.
   60 GG=GG+DG
      A=-XDTGO*XDTGO
      CALL INTERP(GG,TAMA,DELTAR,NB,NPX,DR,NERR)
      CALL INTERP(GG,TAMA,VM,NB,NPX,V,NERR)
      B=2.*XDTGO*(20000.-R+DR*COS(THETA2))-20000.*V*COS(THETA2)
      C=(R-DR*COS(THETA2))*(20000.-R+DR*COS(THETA2))
      VALUE=A*GG*GG+B*GG+C
      AA=ABS(VALUE)
      IF(AA.LT.10000.) GO TO 70
      IF (VALUE.GT.0.) GO TO 60
      AN=AN+1.
      GG=GG-DG
      DG=.1/AN
      GO TO 60
   70 CONTINUE
      IF(IS1.NE.1) PRINT 80,GG
   80 FORMAT(10X,25H T AT GAMA MIN OVERLOAD =F10.4,4H SEC)
      IF(IS1.NE.1) PRINT 90,DR
   90 FORMAT(10X,30H DELTAR AT GAMA MIN OVERLOAD =F10.1,3H FT)
      IF(IS1.NE.1) PRINT 95,V
   95 FORMAT(10X,26H VM AT GAMA MIN OVERLOAD =F10.1,7H FT/SEC)
      A1=20000./(DR*COS(THETA2)-R-XDTGO*GG)
      GGG=-(1.+A1)*G/GG
      IF(IS1.NE.1) PRINT 96,GGG
   96 FORMAT(10X,8H GAMA = F10.4)
      A2=0.48/(1.+GGG)
      PRINT 97,A2
   97 FORMAT(10X,31H SMALLEST BIT A/D RESOLUTION = F10.4,2X,3H FT)
      RETURN
      END
```

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```
    SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  KSCALE

VARIABLES       SN  TYPE          RELOCATION
   353  A         REAL                             360  AA       REAL
  1621  AAA       REAL                COMA         344  AN       REAL
  1620  ARG       REAL                COMA         345  ARG1     REAL
   346  ARG2      REAL                            1444  A1       REAL               COMA
    64  A1P1      REAL                COMP          70  A1P2     REAL               COMP
    74  A1P3      REAL                COMP         100  A1P4     REAL               COMP
   104  A1P5      REAL                COMP         110  A1P6     REAL               COMP
   351  A2        REAL                              63  A2P1     REAL               COMP
    57  A2P2      REAL                COMP          73  A2P3     REAL               COMP
    77  A2P4      REAL                COMP         103  A2P5     REAL               COMP
   107  A2P6      REAL                COMP         356  B        REAL
   357  C         REAL                            1702  CA       REAL               COMA
  1602  CLA       REAL                COMA        1605  CLAA     REAL      ARRAY    COMA
     3  CLMS      REAL      ARRAY     COMP          15  CLS1     REAL      ARRAY    COMP
    27  CLS2      REAL      ARRAY     COMP          70  COSE     REAL               COMA
  1443  CPL       REAL                COMA        1441  CTL      REAL               COMA
  1160  DELTAR    REAL      ARRAY     COMA         343  DG       REAL
   351  DR        REAL                            1261  DXG      REAL               COMA
  1262  DYG       REAL                COMA        1263  DZG      REAL               COMA
  2131  ECOS      REAL      ARRAY     COMA          74  EDOT     REAL               COMA
  2204  FCI77     REAL      ARRAY     COMA        2173  FI7T     REAL      ARRAY    COMA
  1424  F1        REAL                COMA        1425  F2       REAL               COMA
  1426  F3        REAL                COMA        1254  G        REAL               COMA
    73  GAM       REAL                COMA         354  GG       REAL
  1255  GGG       REAL                COMA        1427  G1       REAL               COMA
  1430  G2        REAL                COMA        1431  G3       REAL               COMA
  2152  HR7EE     REAL      ARRAY     COMA          60  ICON     INTEGER            COMP
    56  IFT       INTEGER             COMP          57  IPLANE   INTEGER            COMP
     1  IPTS      INTEGER             COMA           0  I91      INTEGER            COMP
     0  I88       INTEGER             COMP           1  I99      INTEGER            COMP
     0  LEVEL     INTEGER             COMA         350  NB       INTEGER
  1601  NERR      INTEGER             COMA        1603  NPX      INTEGER            COMA
    41  NSAM      INTEGER             COMP        1116  NT       INTEGER            COMA
  1604  NX        INTEGER             COMA        1617  PHO      REAL               COMA
    77  PPX       REAL      ARRAY     COMA         161  PPY      REAL      ARRAY    COMA
   243  PPZ       REAL      ARRAY     COMA        1700  QM       REAL               COMA
  1666  QMM       REAL      ARRAY     COMA          42  Q1       REAL               COMP
    43  Q2        REAL                COMP          44  Q3       REAL               COMP
    45  Q4        REAL                COMP          46  Q5       REAL               COMP
    47  Q6        REAL                COMP         342  R        REAL
    72  RI        REAL                COMA          67  RLB      REAL               COMA
  1422  RLBK      REAL                COMA          76  RN       REAL               COMA
  1436  RRP       REAL                COMA        1701  SA       REAL               COMA
  1423  SCALEP    REAL                COMA        1622  SCALET   REAL               COMA
  1665  SCALEV    REAL                COMA        1440  SPL      REAL               COMA
    71  SPO       REAL                COMA        1437  SR       REAL               COMA
  1442  STL       REAL                COMA        1435  S1       REAL               COMA
    62  S1P1      REAL                COMP          66  S1P2     REAL               COMP
    72  S1P3      REAL                COMP          76  S1P4     REAL               COMP
   102  S1P5      REAL                COMP         106  S1P6     REAL               COMP
  1254  S2        REAL                COMA          61  S2P1     REAL               COMP
```

```
VARIABLES      SN  TYPE              RELOCATION
    65  S2P2        REAL                 COMP              71  S2P3        REAL                 COMP
    75  S2P4        REAL                 COMP             101  S2P5        REAL                 COMP
   105  S2P6        REAL                 COMP            1265  S3          REAL                 COMA
  1266  S4          REAL                 COMA            1267  S5          REAL                 COMA
  1172  TAMA        REAL       ARRAY     COMA              75  THETAL      REAL                 COMA
   347  THETA2      REAL                                  325  TIME        REAL       ARRAY     COMA
  1624  THA         REAL       ARRAY     COMA             407  TMAS        REAL       ARRAY     COMA
  1623  TREAL       REAL                 COMA             355  V           REAL
   352  VALUE       REAL                                 1216  VM          REAL       ARRAY     COMA
  1703  VMX         REAL       ARRAY     COMA            1765  VMY         REAL       ARRAY     COMA
  2047  VMZ         REAL       ARRAY     COMA            1445  VTI         REAL                 COMA
    50  W1          REAL                 COMP              51  W2          REAL                 COMP
    52  W3          REAL                 COMP              53  W4          REAL                 COMP
    54  W5          REAL                 COMP              55  W6          REAL                 COMP
  1432  XC          REAL                 COMA            1117  XCOMP       REAL                 COMA
  1270  XDM         REAL       ARRAY     COMA            1256  XDO         REAL                 COMA
   445  XDTGMS      REAL       ARRAY     COMA              64  XDTGO       REAL                 COMA
  1446  XE          REAL       ARRAY     COMA             577  XMAN        REAL       ARRAY     COMA
  1107  XMISS       REAL       ARRAY     COMA            1662  XTA         REAL                 COMA
     2  XX3         REAL       ARRAY     COMA            1433  YC          REAL                 COMA
  1120  YCOMP       REAL                 COMA            1326  YDM         REAL       ARRAY     COMA
  1257  YDO         REAL                 COMA             503  YDTGMS      REAL       ARRAY     COMA
    65  YDTGO       REAL                 COMA            1504  YE          REAL       ARRAY     COMA
  1663  YTA         REAL                 COMA            1600  ZALT        REAL                 COMA
  1434  ZC          REAL                 COMA            1121  ZCOMP       REAL                 COMA
  1364  ZDM         REAL       ARRAY     COMA            1260  ZDO         REAL                 COMA
   541  ZDTGMS      REAL       ARRAY     COMA              66  ZDTGO       REAL                 COMA
  1542  ZE          REAL       ARRAY     COMA            1664  ZTA         REAL                 COMA
     J  Z1          RETURNS

FILE NAMES         MODE
        OUTPUT     FMT

EXTERNALS           TYPE     ARGS
        ATAN2       REAL       2 LIBRARY                  BOS         REAL         1 LIBRARY
        INTERP                 7                          SQRT        REAL         1 LIBRARY

INLINE FUNCTIONS    TYPE     ARGS
        ABS         REAL       1  INTRIN

STATEMENT LABELS
    11  10                               52  20                               226  30       FMT
    56  40                              241  50       FMT                      65  60
   133  70                              256  80       FMT                     270  90       FMT
   302  95       FMT                    314  96       FMT                     323  97       FMT

COMMON BLOCKS    LENGTH
        COMA       1165
        COMP         73

STATISTICS
  PROGRAM LENGTH                3628     242
  CM LABELED COMMON LENGTH     23268    1238
```

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```
      SUBROUTINE PRIME
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                 PPX(50),PPY(50),PPZ(50),TIME(50),TMAS(30),XDTGMS(30)
     *                ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *                ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDO,YDO,ZDO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHC,ARG,AAA,SCALET,TREAL,TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *                  XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *                 ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      COMMON /ANG/ SINSO,COSSO,SINSCO,COSSCO
      COMMON/DELT/PPXS(50),PPYS(50),PPZS(50),VMXS(50),VMYS(50),VMZS(50)
      COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
     *,XDDE,YDDE,ZDDE
      COMMON /MU/ COSMU1,SINMU1,COSMU2,SINMU2,COSMU3,SINMU3
      COMMON/MISD/XM(3),YM(3),ZM(3),RM(3),NOPT,ICN
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
      REAL    MU1,MU2,MU3
      DATA  RTD,DTR/57.2957795,0.01745329/
   50 CONTINUE
      TLAST = TIMES(NADJ)
      TFIRST = TIMES(1)
      TSPAN = TLAST - TFIRST
      THALF = TFIRST + TSPAN / 2.
C*** INTERP RETURNS THESE VALUES FROM TAU ADJUSTED TARGET VELOCITY-TIME
C*** MANEUVER TABLE IN EARTH FIXED COORDINATES.
      CALL INTERP (TLAST,TMA,XDM,NT,NPX,XDEL,NERR)
      CALL INTERP (TFIRST,TMA,XDM,NT,NPX,XDEF,NERR)
      XDDE = (XDEL - XDEF) / TSPAN
      CALL INTERP (TLAST,TMA,YDM,NT,NPX,YDEL,NERR)
      CALL INTERP (TFIRST,TMA,YDM,NT,NPX,YDEF,NERR)
      YDDE = (YDEL - YDEF) / TSPAN
      CALL INTERP (TLAST,TMA,ZDM,NT,NPX,ZDEL,NERR)
      CALL INTERP (TFIRST,TMA,ZDM,NT,NPX,ZDEF,NERR)
      ZDDE=(ZDEL-ZDEF)/TSPAN -32.174
C*** COMPONENTS OF AERODYNAMIC ACCELERATION IN EARTH FIXED COORDINATES
      XD = XDDE
      YD = YDDE
      ZD = ZDDE
C*** TRANSFORM THESE TO LAUNCH COORDINATES
      CALL GUID
C*** COMPONENTS OF AERODYNAMIC ACCELERATION IN LAUNCH COORDINATES
      XDDTG = XDTG
      YDDTG = YDTG
      ZDDTG = ZDTG
C*** DEFINE X- Y- AND ZDTG5
      CALL INTERP (THALF,TMA,XDTGM,NT,NPX,XDTG5,NERR)
C*** INTERP RETURNS THESE VALUES FROM TAU ADJUSTED TARGET VELOCITY-TIME
C*** MANEUVER TABLE IN LAUNCH COORDINATES.
```

```
      CALL INTERP (THALF,TMA,YDTGM,NT,NPX,YDTG5,NERR)
      CALL INTERP (THALF,THA,ZDTGM,NT,NPX,ZDTG5,NERR)
C*** CALCULATE THE ANGLES USED FOR THE T-MATRIX
   51 IF(ZDTG5.NE.0.0) MU1=ATAN2(YDTG5,ZDTG5)
      IF(ZDTG5.EQ.0.0.AND.YDTG5.EQ.0.0) MU1=0.0
      IF(ZDTG5.EQ.0.0.AND.YDTG5.GT.0.0) MU1=90.*DTR
      IF(ZDTG5.EQ.0.0.AND.YDTG5.LT.0.0) MU1=270.*DTR
   52 IF(XDTG5.GT.0.0) GO TO 53
      IF(XDTG5.LT.0.0) GO TO 54
      MU2=0.0
      GO TO 55
   53 IF(YDTG5.EQ.0.0.AND.ZDTG5.EQ.0.0) MU2=270.*DTR
      ARG=SQRT(YDTG5**2+ZDTG5**2)
      IF(YDTG5.NE.0.0.OR.ZDTG5.NE.0.0) MU2=360.*DTR-ATAN2(XDTG5,ARG)
      GO TO 55
   54 IF(YDTG5.EQ.0.0.AND.ZDTG5.EQ.0.0) MU2=90.*DTR
      ARG=SQRT(YDTG5**2+ZDTG5**2)
      IF(YDTG5.NE.0.0.OR.ZDTG5.NE.0.0) MU2=-ATAN2(XDTG5,ARG)
   55 CONTINUE
C*** DEFINE THE VALUES USED IN THE T-MATRIX
      COSMU1 = COS(MU1)
      SINMU1 = SIN(MU1)
      COSMU2 = COS(MU2)
      SINMU2 = SIN(MU2)
      ARG1=ZDDTG*SINMU1-YDDTG*COSMU1
      ARG2=XDDTG*COSMU2+YDDTG*SINMU1*SINMU2+ZDDTG*COSMU1*SINMU2
      MU3=ATAN2(ARG1,ARG2)
      COSMU3 = COS(MU3)
      SINMU3 = SIN(MU3)
      IF(ICN.NE.1.AND.III.EQ.1) GO TO 70
      IF(IS1.EQ.1) GO TO 70
      PRINT 862,LEVEL,XDDTG,YDDTG,ZDDTG,XDTG5,YDTG5,ZDTG5
   70 CONTINUE
C*** CHANGE RADIANS TO DEGREES FOR PRINT OUT
      MU1  = MU1  * RTD
      MU2  = MU2  * RTD
      MU3  = MU3  * RTD
      IF(IS1.EQ.1) GO TO 90
      IF(ICN.EQ.1.OR.III.NE.1) PRINT 901,MU1,MU2,MU3
   90 CONTINUE
  862 FORMAT(10X,53H MANEUVER WAS IN PROGRESS AT TIME OF DATA COLLECTION
     *./10X,8H LEVEL =,I5,5X,8H XDDTG =,F10.4,5X,8H YDDTG =,F10.4,5X,
     *8H ZDDTG =,F10.4/10X,8H XDTG5 =,F10.4,5X,8H YDTG5 =,F10.4,5X,
     *8H ZDTG5 =,F10.4)
  901 FORMAT(1H0,10X,6H MU1 = F8.2,5X,6H MU2 = F8.2,5X,6H MU3 = F8.2)
      RETURN
      END
```

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      SUBROUTINE PRIME       74/74    OPT=1                          FTNH 4.2+75348       01/12/76  14.31.17.       PAGE      3

      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1  PRIME

VARIABLES       SN  TYPE            RELOCATION
  1621  AAA         REAL                 COMA          1620  ARG       REAL                COMA
   433  ARG1        REAL                                434  ARG2      REAL
  1444  A1          REAL                 COMA            64  A1P1      REAL                COMP
    70  A1P2        REAL                 COMP            74  A1P3      REAL                COMP
   100  A1P4        REAL                 COMP           104  A1P5      REAL                COMP
   110  A1P6        REAL                 COMP            63  A2P1      REAL                COMP
    67  A2P2        REAL                 COMP            73  A2P3      REAL                COMP
    77  A2P4        REAL                 COMP           103  A2P5      REAL                COMP
   107  A2P6        REAL                 COMP          1702  CA        REAL                COMA
  1602  CLA         REAL                 COMA          1605  CLAA      REAL      ARRAY     COMA
     3  CLMS        REAL      ARRAY      COMP            15  CLS1      REAL      ARRAY     COMP
    27  CLS2        REAL      ARRAY      COMP            70  COSE      REAL                COMA
     0  COSMU1      REAL                 MU               2  COSMU2    REAL                MU
     4  COSMU3      REAL                 MU               3  COSSCO    REAL                ANG
     1  COSSO       REAL                 ANG           1443  CPL       REAL                COMA
  1441  CTL         REAL                 COMA          1160  DELTAR    REAL      ARRAY     COMA
   333  DTR         REAL                               1261  DXG       REAL                COMA
  1252  DYG         REAL                 COMA          1263  DZG       REAL                COMA
  2131  ECOS        REAL      ARRAY      COMA            74  EDOT      REAL                COMA
  2204  FCI77       REAL      ARRAY      COMA          2173  FI77      REAL      ARRAY     COMA
  1424  F1          REAL                 COMA          1425  F2        REAL                COMA
  1426  F3          REAL                 COMA          1254  G         REAL                COMA
    73  GAM         REAL                 COMA          1255  GGG       REAL                COMA
  1427  G1          REAL                 COMA          1430  G2        REAL                COMA
  1431  G3          REAL                 COMA          2152  HR7EE     REAL      ARRAY     COMA
    15  ICN         INTEGER              MISD            60  ICON      INTEGER             COMP
    56  IFT         INTEGER              COMP         10332  III       INTEGER             MANEUV
    97  IPLANE      INTEGER              COMP             1  IPTS      INTEGER             COMA
     0  IS1         INTEGER              COMP         10236  ITAU      INTEGER   ARRAY     MANEUV
 10142  ITRAJ       INTEGER   ARRAY      MANEUV           0  ITT       INTEGER             MANEUV
     2  I88         INTEGER              COMP             1  I99       INTEGER             COMP
     0  LEVEL       INTEGER              COMA           413  MU1       REAL
   414  MU2         REAL                                415  MU3       REAL
 10333  NADJ        INTEGER              MANEUV        1601  NERR      INTEGER             COMA
    14  NOPT        INTEGER              MISD          1603  NPX       INTEGER             COMA
    41  NSAM        INTEGER              COMP          1116  NT        INTEGER             COMA
  1604  NX          INTEGER              COMA          1617  PHO       REAL                COMA
    77  PPX         REAL      ARRAY      COMA             0  PPXS      REAL      ARRAY     DELT
   161  PPY         REAL      ARRAY      COMA            62  PPYS      REAL      ARRAY     DELT
   243  PPZ         REAL      ARRAY      COMA           144  PPZS      REAL      ARRAY     DELT
  1700  QM          REAL                 COMA          1666  QMM       REAL      ARRAY     COMA
    42  Q1          REAL                 COMP            43  Q2        REAL                COMP
    44  Q3          REAL                 COMP            45  Q4        REAL                COMP
    46  Q5          REAL                 COMP            47  Q6        REAL                COMP
    72  RI          REAL                 COMA            67  RLB       REAL                COMA
  1422  RLBK        REAL                 COMA            11  RM        REAL      ARRAY     MISD
    76  RN          REAL                 COMA          1436  RRR       REAL                COMA
   332  RTD         REAL                               1701  SA        REAL                COMA
  1423  SCALEP      REAL                 COMA          1622  SCALET    REAL                COMA
  1655  SCALEV      REAL                 COMA             1  SINMU1    REAL                MU
     3  SINMU2      REAL                 MU               5  SINMU3    REAL                MU
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        SUBROUTINE PRIME       74/74    OPT=1                              FTNH 4.2+75348       01/12/76  14.31.17.        PAGE    4

  VARIABLES       SN  TYPE             RELOCATION
         2  SINSCO    REAL                    ANG               0  SINSO     REAL                   ANG
      1440  SPL       REAL                    COMA             71  SPO       REAL                   COMA
      1437  SR        REAL                    COMA           1442  STL       REAL                   COMA
      1435  S1        REAL                    COMA             62  S1P1      REAL                   COMP
        56  S1P2      REAL                    COMP             72  S1P3      REAL                   COMP
        76  S1P4      REAL                    COMP            102  S1P5      REAL                   COMP
       106  S1P6      REAL                    COMP           1264  S2        REAL                   COMA
        61  S2P1      REAL                    COMP             65  S2P2      REAL                   COMP
        71  S2P3      REAL                    COMP             75  S2P4      REAL                   COMP
       101  S2P5      REAL                    COMP            105  S2P6      REAL                   COMP
      1265  S3        REAL                    COMA           1266  S4        REAL                   COMA
      1267  S5        REAL                    COMA           1122  TAMA      REAL        ARRAY      COMA
       417  TFIRST    REAL                                    421  THALF     REAL
        75  THETAL    REAL                    COMA            325  TIME      REAL        ARRAY      COMA
     10050  TIMES     REAL       ARRAY        MANEUV          416  TLAST     REAL
      1624  TMA       REAL       ARRAY        COMA            407  TMAS      REAL        ARRAY      COMA
      1623  TREAL     REAL                    COMA            420  TSPAN     REAL
      1216  VM        REAL       ARRAY        COMA           1703  VMX       REAL        ARRAY      COMA
       226  VMXS      REAL       ARRAY        DELT           1765  VMY       REAL        ARRAY      COMA
       310  VMYS      REAL       ARRAY        DELT           2047  VMZ       REAL        ARRAY      COMA
       372  VMZS      REAL       ARRAY        DELT           1445  VTI       REAL                   COMA
        50  W1        REAL                    COMP             51  W2        REAL                   COMP
        52  W3        REAL                    COMP             53  W4        REAL                   COMP
        54  W5        REAL                    COMP             55  W6        REAL                   COMP
      1432  XC        REAL                    COMA           1117  XCOMP     REAL                   COMA
         0  XD        REAL                    COMB             12  XDDE      REAL                   COMB
       425  XDDTG     REAL                                      6  XDEF      REAL                   COMB
       422  XDEL      REAL                                      1  XDEM      REAL        ARRAY      MANEUV
      1270  XDM       REAL       ARRAY        COMA           1256  XDO       REAL                   COMA
         3  XDTG      REAL                    COMB           7723  XDTGM     REAL        ARRAY      MANEUV
       445  XDTGMS    REAL       ARRAY        COMA             64  XDTGO     REAL                   COMA
       430  XDTG5     REAL                                   1446  XE        REAL        ARRAY      COMA
         0  XM        REAL       ARRAY        MISD            577  XMAN      REAL        ARRAY      COMA
      1107  XMISS     REAL       ARRAY        COMA          10059  XPRIME    REAL                   MANEUV
      1698  XTA       REAL                    COMA              2  XX6       REAL        ARRAY      COMA
      1433  Y6        REAL                    COMA           1120  YCOMP     REAL                   COMA
         1  YD        REAL                    COMB             13  YDDE      REAL                   COMB
       426  YDDTG     REAL                                      7  YDEF      REAL                   COMB
       423  YDEL      REAL                                   2507  YDEM      REAL        ARRAY      MANEUV
      1326  YDM       REAL       ARRAY        COMA           1257  YDO       REAL                   COMA
         4  YDTG      REAL                    COMB           7761  YDTGM     REAL        ARRAY      MANEUV
       503  YDTGMS    REAL       ARRAY        COMA             65  YDTGO     REAL                   COMA
       431  YDTG5     REAL                                   1504  YE        REAL        ARRAY      COMA
         3  YM        REAL       ARRAY        MISD          10096  YPRIME    REAL                   MANEUV
      1653  YTA       REAL                    COMA           1600  ZALT      REAL                   COMA
      1434  ZC        REAL                    COMA           1121  ZCOMP     REAL                   COMA
         2  ZD        REAL                    COMB             14  ZDDE      REAL                   COMB
       427  ZDDTG     REAL                                     10  ZDEF      REAL                   COMB
       424  ZDEL      REAL                                   5215  ZDEM      REAL        ARRAY      MANEUV
      1354  ZDM       REAL       ARRAY        COMA           1260  ZDO       REAL                   COMA
         5  ZDTG      REAL                    COMB          10017  ZDTGM     REAL        ARRAY      MANEUV
       541  ZDTGMS    REAL       ARRAY        COMA             66  ZDTGO     REAL                   COMA
       432  ZDTG5     REAL                                   1542  ZE        REAL        ARRAY      COMA
         6  ZM        REAL       ARRAY        MISD          10057  ZPRIME    REAL                   MANEUV
      1664  ZTA       REAL                    COMA             11  ZZZ       REAL                   COMB
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      SUBROUTINE PRIME       74/74    OPT=1                        FTNH 4.2+75348       01/12/76  14.31.17.       PAGE     5

FILE NAMES        MODE
      OUTPUT     FMT

EXTERNALS         TYPE    ARGS
      ATAN2      REAL      2 LIBRARY                    COS        REAL        1 LIBRARY
      GUID                 0                            INTERP                 7
      SIN        REAL      1 LIBRARY                    SQRT       REAL        1 LIBRARY

STATEMENT LABELS
    0  50            INACTIVE             0  51          INACTIVE               0  52            INACTIVE
  106  53                               131  54                               151  55
  206  70                               221  90                               354  862       FMT
  403  301       FMT

COMMON BLOCKS   LENGTH
      COMA        1165
      MANEUV      4316
      ANG            4
      DELT         300
      COMD          13
      MU             6
      MISO          14
      COMP          73

STATISTICS
   PROGRAM LENGTH                  435B       285
   CM LABELED COMMON LENGTH      13403B      5891
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```
      SUBROUTINE MISCOM
C
C     THIS SUBROUTINE CALCULATES THE MISS DISTANCES IN THE TARGET
C     COORDINATE SYSTEM
C
      COMMON/MISD/XM(3),YM(3),ZM(3),RM(3),N,ICN
      COMMON/DELT/X(50),Y(50),Z(50),VMXS(50),VMYS(50),VMZS(50)
      COMMON /MU/ COSMU1,SINMU1,COSMU2,SINMU2,COSMU3,SINMU3
      COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
     *,XDDE,YDDE,ZDDE
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *                  XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *                ZPRIME,TIMES(50),ITRAJ(60),ITAJ(60),III,NADJ
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *                PPX(50),PPY(50),PPZ(50),TIME(50),THAS(30),XDTGMS(30)
     *              ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *              ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XOO,YOO,ZOO,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHO,ARG,AAA,SCALET,TREAL,THA(30),XTA,YTA,ZTA,SCALEV,QHH(10),QH
     *,SA,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/STARG/FXA,FYA,FZA,FXB,FYB,FZB,FXC,FYC,FZC,AT,VT
      COMMON/COMD/COSA,COSB,COSG,YA,ZA
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q5,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
      COMMON/EXTRA/NPTS,DX,XTERM,KKK,AS,SEO,SC,ASEO,R,SCALEL,VVVV,C1,
     *XLOS,YLOS,ZLOS,CO,CX,CY,CLY,CLZ,TRP,XX(50),THE
      DIMENSION  T(50),XT(50),YT(50),ZT(50)
      DTR=0.01745329
      DDX=DX
      II=0
      XN=FLOAT(N)
      SMX=0.
      SMX2=0.
C
C*** NEXT CARD IS TAPE SPECIFIC FOR ITT=1 FOR STATIONARY TARGET
      IF(ITT.EQ.1) GO TO 19
      FX = COSMU2 * COSMU3
      FY=SINMU1*SINMU2*COSMU3-COSMU1*SINMU3
      FZ=SINMU1*SINMU3+COSMU1*SINMU2*COSMU3
      FXA = FX
      FYA = FY
      FZA = FZ
      FX=COSMU2*SINMU3
      FY=COSMU1*COSMU3+SINMU1*SINMU2*SINMU3
      FZ=COSMU1*SINMU2*SINMU3-SINMU1*COSMU3
      FXB = FX
      FYB = FY
      FZB = FZ
      FX=-SINMU2
      FY=SINMU1*COSMU2
      FZ = COSMU1 *COSMU2
```

```
      SUBROUTINE MISCOM
C
C     THIS SUBROUTINE CALCULATES THE MISS DISTANCES IN THE TARGET
C     COORDINATE SYSTEM
C
      COMMON/MISD/XM(3),YM(3),ZM(3),RM(3),N,ICN
      COMMON/DELT/X(50),Y(50),Z(50),VMXS(50),VMYS(50),VMZS(50)
      COMMON /MU/ COSMU1,SINMU1,COSMU2,SINMU2,COSMU3,SINMU3
      COMMON /COMB/XD,YD,ZD,XDTG,YDTG,ZDTG,XDEF,YDEF,ZDEF,ZZZ
     *,XDDE,YDDE,ZDDE
      COMMON/MANEUV/ITT,XDEM(30,45),YDEM(30,45),ZDEM(30,45),
     *               XDTGM(30),YDTGM(30),ZDTGM(30),XPRIME,YPRIME,
     *               ZPRIME,TIMES(50),ITRAJ(60),ITAU(60),III,NADJ
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,RI,
     *GAM,EDOT,THETAL,RN,
     *              PPX(50),PPY(50),PPZ(50),TIME(50),THAS(30),XDTGMS(30)
     *             ,YDTGMS(30),ZDTGMS(30),XMAN(4,50),XMISS(7),NT
     *             ,XCOMP,YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG
     *,XDD,YDD,ZDD,DXG,DYG,DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),
     *RLBK,SCALEP,F1,F2,F3,G1,G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,
     *CPL,A1,VTI,XE(30),YE(30),ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),
     *PHS,ARG,AAA,SCALET,TREAL,THA(30),XTA,YTA,ZTA,SCALEV,QMH(10),QM
     *,S4,CA,VMX(50),VMY(50),VMZ(50)
     *,ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/STARG/FXA,FYA,FZA,FXB,FYB,FZB,FXC,FYC,FZC,AT,VT
      COMMON/COMD/COSA,COSB,COSG,YA,ZA
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
      COMMON/EXTRA/NPTS,DX,XTERM,KKK,AS,SEO,SC,ASEO,R,SCALEL,VVVV,C1,
     *XLOS,YLOS,ZLOS,CO,CX,CY,CLY,CLZ,TRP,XX(50),THE
      DIMENSION  T(50),XT(50),YT(50),ZT(50)
      DTR=0.01745329
      UDX=UX
      II=0
      XN=FLOAT(N)
      SMX=0.
      SMX2=0.
C
C*** NEXT CARD IS TAPE SPECIFIC FOR ITT=1 FOR STATIONARY TARGET
      IF(ITT.EQ.1) GO TO 19
      FX = COSMU2 * COSMU3
      FY=SINMU1*SINMU2*COSMU3-COSMU1*SINMU3
      FZ=SINMU1*SINMU3+COSMU1*SINMU2*COSMU3
      FXA = FX
      FYA = FY
      FZA = FZ
      FX=COSMU2*SINMU3
      FY=COSMU1*COSMU3+SINMU1*SINMU2*SINMU3
      FZ=COSMU1*SINMU2*SINMU3-SINMU1*COSMU3
      FXB = FX
      FYB = FY
      FZB = FZ
      FX=-SINMU2
      FY=SINMU1*COSMU2
      FZ = COSMU1 *COSMU2
```

```
      FXC = FX
      FYC = FY
      FZC = FZ
   19 CONTINUE
      IF((ITT.EQ.1.OR.VVVV.LT.338.0).AND.IS1.NE.1) PRINT 67
      IF((ITT.NE.1.OR.VVVV.GE.338.0).AND.IS1.NE.1) PRINT 66
      DO 1 I=1,N
      DX = X(I)
      DY = Y(I)
      DZ = Z(I)
C*** NEXT CARD IS TAPE SPECIFIC FOR ITT=1 FOR STATIONARY TARGET
      IF(ITT.EQ.1) GO TO 30
      IF(VVVV.LT.338.0) GO TO 30
C    TRANSFORM (MISSILE MINUS TARGET) LAUNCH COORDINATES TO GENERALIZED
C    TARGET COORDINATES
C     REFERENCED TO ORIGIN AT TAILPIPE
      XT(I) = FXA*DX + FYA*DY + FZA*DZ
      YT(I) = FXB*DX + FYB*DY + FZB*DZ
      ZT(I) = FXC*DX + FYC*DY + FZC*DZ
C    CALCULATE TARGET ANGLE OF ATTACK
      AAA=1116.89+0.003894*ZZZ
      VT=SQRT(XDEF**2+YDEF**2+ZDEF**2)
      ARG=0.00003*ZZZ
      PHO=0.00237692*EXP(ARG)
      QM=VT/AAA
      NPX=2
      NX=8
      CALL INTERP (QM,QMM,CLAA,NX,NPX,CLA,NERR)
      WT=18500.0
      ST=248.0
      AT=2.*WT*SQRT(XDDE**2+YDDE**2+ZDDE**2)/(PHO*VT*VT*ST*CLA*32.174)
      IF(IS1.EQ.1) GO TO 5
      IF(ICN.EQ.1.AND.I.EQ.1) PRINT 25,AT
    5 CONTINUE
      AT=AT*DTR
      XS=XT(I)
      YS=YT(I)
      ZS=ZT(I)
C    TRANSFORM GENERALIZED TARGET COORDINATES TO TARGET FIXED COORDINATES
C     REFERENCED TO ORIGIN AT TAILPIPE
      XT(I)=ZS*COS(AT)+XS*SIN(AT)
      YT(I)=-YS
      ZT(I)=XS*COS(AT)-ZS*SIN(AT)
      GO TO 4
C    TRANSFORM MISSILE LAUNCH COORDINATES TO TARGET EARTH FIXED
C     COORDINATES. TARGET IS STATIONARY OR MOVING AT LESS THAN 338 FT/SEC
   30 XT(I)=DX*S2-DY*SPL+DZ*S3
      YT(I)=DX*S4+DY*CPL+DZ*S5
      ZT(I)=-DX*STL+DZ*CTL
    4 CONTINUE
      IF(IS1.NE.1) PRINT 15,XT(I),YT(I),ZT(I)
   15 FORMAT(3(3X,E11.4))
      SMX=SMX+XT(I)
    1 SMX2=SMX2+XT(I)*XT(I)
C
      DO 20 I=1,N
      T(I) = YT(I)
```

```
       20 CONTINUE
C     CALCULATE COEFFICIENTS FOR MISSILE PATH PROJECTIONS IN TARGET FIXED
C     COORDINATES
C      REFERENCED TO ORIGIN AT TAILPIPE
       21 SMT=0.0
          SMXT=0.
          DO 2 I=1,N
          SMT=SMT+T(I)
        2 SMXT=SMXT+XT(I)*T(I)
          D=XN*SMX2-SMX*SMX
          B=(SMT*SMX2-SMX*SMXT)/D
          A=(XN*SMXT-SMT*SMX)/D
C
          II= II + 1
C
       99 GO TO(10,11),II
C     YF-AXIS INTERCEPT AND SLOPE OF PATH PROJECTION IN XF-YF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
       10 YM(1)= B
          YA=A
C
      102 DO 3 I=1,N
          T(I) = ZT(I)
        3 CONTINUE
          GO TO 21
C     ZF-AXIS INTERCEPT AND SLOPE OF PATH PROJECTION IN XF-ZF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
       11 ZM(1)= B
          ZA=A
C
C     XF-AXIS COORDINATE OF PATH PIERCING POINT IN XF-YF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
          XM(2)= -ZM(1)/ZA
C     YF-AXIS COORDINATE OF PATH PIERCING POINT IN XF-YF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
          YM(2)= YM(1) + YA*XM(2)
C
C     XF-AXIS COORDINATE OF PATH PIERCING POINT IN XF-ZF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
          XM(3)= -YM(1)/YA
C     ZF-AXIS COORDINATE OF PATH PIERCING POINT IN XF-ZF PLANE
C      REFERENCED TO ORIGIN AT TAILPIPE
          ZM(3)= ZM(1) + ZA*XM(3)
C
          XM(1)= 0.
          ZM(2)= 0.
          YM(3)= 0.
C     CALCULATE NEAREST APPROACH TO ORIGIN IN YF-ZF,XF-YF,AND XF-ZF PLANES
C      REFERENCED TO ORIGIN AT TAILPIPE
          DO 155 I=1,3
      155 RM(I)= SQRT(XM(I)*XM(I) + YM(I)*YM(I) + ZM(I)*ZM(I))
          DX=DDX
C
       25 FORMAT(10X,25H TARGET ANGLE OF ATTACK = ,F5.2,3X,4H DEG)
       66 FORMAT(//10X,50H TARGET FIXED COORDINATES OF MISSILE REFERENCED TO
     *              10H TAILPIPE.//)
       67 FORMAT(//10X,43H TARGET EARTH FIXED COORDINATES OF MISSILE.//)
```

```
      RETURN
      END
```

BEST AVAILABLE COPY

```
        SUBROUTINE MISCOM     74/74    OPT=1                        FTNH 4.2+75348      01/12/76  14.31.22.       PAGE    5

        SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1   MISCOM

VARIABLES       SN  TYPE              RELOCATION
   462  A           REAL                             1621  AAA        REAL                COMA
  1520  ARG         REAL                  COMA          4  AS         REAL                EXTRA
     7  ASEO        REAL                  EXTRA        11  AT         REAL                GTARG
  1444  A1          REAL                  COMA         64  A1P1       REAL                COMP
    70  A1P2        REAL                  COMP         74  A1P3       REAL                COMP
   100  A1P4        REAL                  COMP        104  A1P5       REAL                COMP
   110  A1P6        REAL                  COMP         63  A2P1       REAL                COMP
    57  A2P2        REAL                  COMP         73  A2P3       REAL                COMP
    77  A2P4        REAL                  COMP        103  A2P5       REAL                COMP
   107  A2P5        REAL                  COMP        461  B          REAL
  1702  CA          REAL                  COMA       1602  CLA        REAL                COMA
  1605  CLA1        REAL        ARRAY     COMA          3  CLMS       REAL      ARRAY     COMP
    15  CLS1        REAL        ARRAY     COMP         27  CLS2       REAL      ARRAY     COMP
    22  CLY         REAL                  EXTRA        23  CLZ        REAL                EXTRA
    17  CO          REAL                  EXTRA         0  COSA       REAL                COMD
     1  COSB        REAL                  COMD         70  COSE       REAL                COMA
     2  COSG        REAL                  COMD          0  COSMU1     REAL                MU
     2  COSMU2      REAL                  MU            4  COSMU3     REAL                MU
  1443  CPL         REAL                  COMA       1441  CTL        REAL                COMA
    20  CX          REAL                  EXTRA        21  CY         REAL                EXTRA
    13  C1          REAL                  EXTRA       460  D          REAL
   436  DDX         REAL                             1160  DELTAR     REAL      ARRAY     COMA
   435  DTR         REAL                                1  DX         REAL                EXTRA
  1251  DXG         REAL                  COMA        447  DY         REAL
  1252  DYG         REAL                  COMA        450  DZ         REAL
  1253  DZG         REAL                  COMA       2131  ECOS       REAL      ARRAY     COMA
    74  EDOT        REAL                  COMA       2204  FCI77      REAL      ARRAY     COMA
  2173  FIT         REAL        ARRAY     COMA        443  FX         REAL
     0  FXA         REAL                  GTARG         3  FXB        REAL                GTARG
     6  FXB         REAL                  GTARG       444  FY         REAL
     1  FYA         REAL                  GTARG         4  FYB        REAL                GTARG
     7  FYC         REAL                  GTARG       445  FZ         REAL
     2  FZA         REAL                  GTARG         5  FZB        REAL                GTARG
    10  FZC         REAL                  GTARG      1424  F1         REAL                COMA
  1425  F2          REAL                  COMA       1426  F3         REAL                COMA
  1254  G           REAL                  COMA         73  GAM        REAL                COMA
  1255  GGG         REAL                  COMA       1427  G1         REAL                COMA
  1430  G2          REAL                  COMA       1431  G3         REAL                COMA
  2152  HR7EE       REAL        ARRAY     COMA        446  I          INTEGER
    15  ICN         INTEGER               MISD         60  ICON       INTEGER             COMP
    56  IFT         INTEGER               COMP        437  II         INTEGER
 10332  III         INTEGER               MANEUV       57  IPLANE     INTEGER             COMP
     1  IPTS        INTEGER               COMA          0  IS1        INTEGER             COMP
 10236  ITAU        INTEGER     ARRAY     MANEUV    10142  ITRAJ      INTEGER   ARRAY     MANEUV
     0  ITT         INTEGER               MANEUV        2  I88        INTEGER             COMP
     1  I99         INTEGER               COMP          3  KKK        INTEGER             EXTRA
     0  LEVEL       INTEGER               COMA         14  N          INTEGER             MISD
 10333  NADJ        INTEGER               MANEUV     1601  NERR       INTEGER             COMA
     0  NPTS        INTEGER               EXTRA      1603  NPX        INTEGER             COMA
    41  NSAM        INTEGER               COMP       1116  NT         INTEGER             COMA
  1604  NX          INTEGER               COMA       1617  PHO        REAL.               COMA
```

VARIABLES	SN	TYPE		RELOCATION					
77	PPX	REAL	ARRAY	COMA	161	PPY	REAL	ARRAY	COMA
243	PPZ	REAL	ARRAY	COMA	1700	QM	REAL		COMA
1666	QMM	REAL	ARRAY	COMA	42	Q1	REAL		COMP
43	Q2	REAL		COMP	44	Q3	REAL		COMP
45	Q4	REAL		COMP	46	Q5	REAL		COMP
47	Q6	REAL		COMP	10	R	REAL		EXTRA
72	RI	REAL		COMA	67	RLB	REAL		COMA
1422	RLBK	REAL		COMA	11	RM	REAL	ARRAY	MISD
76	RN	REAL		COMA	1436	RRR	REAL		COMA
1701	SA	REAL		COMA	6	SC	REAL		EXTRA
11	SCALEL	REAL		EXTRA	1423	SCALEP	REAL		COMA
1622	SCALET	REAL		COMA	1665	SCALEV	REAL		COMA
5	SEO	REAL		EXTRA	1	SINMU1	REAL		MU
3	SINMU2	REAL		MU	5	SINMU3	REAL		MU
456	SMT	REAL			441	SMX	REAL		
457	SMXT	REAL			442	SMX2	REAL		
1440	SPL	REAL		COMA	71	SPO	REAL		COMA
1437	SR	REAL		COMA	452	ST	REAL		
1442	STL	REAL		COMA	1435	S1	REAL		COMA
62	S1P1	REAL		COMP	66	S1P2	REAL		COMP
72	S1P3	REAL		COMP	76	S1P4	REAL		COMP
102	S1P5	REAL		COMP	106	S1P6	REAL		COMP
1254	S2	REAL		COMA	61	S2P1	REAL		COMP
65	S2P2	REAL		COMP	71	S2P3	REAL		COMP
75	S2P4	REAL		COMP	101	S2P5	REAL		COMP
105	S2P6	REAL		COMP	1265	S3	REAL		COMA
1266	S4	REAL		COMA	1267	S5	REAL		COMA
463	T	REAL	ARRAY		1122	TAMA	REAL	ARRAY	COMA
107	THE	REAL		EXTRA	75	THETAL	REAL		COMA
325	TIME	REAL	ARRAY	COMA	10060	TIMES	REAL	ARRAY	MANEUV
1624	TMA	REAL	ARRAY	COMA	407	TMAS	REAL	ARRAY	COMA
1623	TREAL	REAL		COMA	24	TRP	REAL		EXTRA
1216	VM	REAL	ARRAY	COMA	1703	VMX	REAL	ARRAY	COMA
228	VMXS	REAL	ARRAY	DELT	1789	VMY	REAL	ARRAY	COMA
318	VMYS	REAL	ARRAY	DELT	2047	VMZ	REAL	ARRAY	COMA
372	VMZS	REAL	ARRAY	DELT	12	VT	REAL		GTARG
1445	VTI	REAL		COMA	12	VVVV	REAL		EXTRA
451	WT	REAL			50	W1	REAL		COMP
51	W2	REAL		COMP	52	W3	REAL		COMP
53	W4	REAL		COMP	54	W5	REAL		COMP
55	W6	REAL		COMP	0	X	REAL	ARRAY	DELT
1432	XC	REAL		COMA	1117	XCOMP	REAL		COMA
0	XD	REAL		COMB	12	XDDE	REAL		COMB
6	XDEF	REAL		COMB	1	XDEM	REAL	ARRAY	MANEUV
1270	XDM	REAL	ARRAY	COMA	1256	XDO	REAL		COMA
3	XDTG	REAL		COMB	7723	XDTGM	REAL	ARRAY	MANEUV
445	XDTGMS	REAL	ARRAY	COMA	64	XDTGO	REAL		COMA
1446	XE	REAL	ARRAY	COMA	14	XLOS	REAL		EXTRA
0	XM	REAL	ARRAY	MISD	577	XMAN	REAL	ARRAY	COMA
1107	XMISS	REAL	ARRAY	COMA	440	XN	REAL		
10655	XPRIME	REAL		MANEUV	453	XS	REAL		
545	XT	REAL	ARRAY		1662	XTA	REAL		COMA
2	XTERM	REAL		EXTRA	25	XX	REAL	ARRAY	EXTRA
2	XXS	REAL	ARRAY	COMA	62	Y	REAL	ARRAY	DELT
3	YA	REAL		COMD	1433	YC	REAL		COMA
1123	YCOMP	REAL		COMA	1	YD	REAL		COMB
13	YDDE	REAL		COMB	7	YDEF	REAL		COMB

```
VARIABLES     SN  TYPE          RELOCATION
  2507  YDEM      REAL      ARRAY   MANEUV        1326  YDM       REAL      ARRAY   COMA
  1257  YDO       REAL              COMA             4  YDTG      REAL              COMB
  7761  YDTGM     REAL      ARRAY   MANEUV         503  YDTGMS    REAL      ARRAY   COMA
    65  YDTGO     REAL              COMA          1504  YE        REAL      ARRAY   COMA
    15  YLOS      REAL              EXTRA            3  YM        REAL      ARRAY   MISD
 10056  YPRIME    REAL              MANEUV         454  YS        REAL
   627  YT        REAL      ARRAY                 1663  YTA       REAL              COMA
   144  Z         REAL      ARRAY   DELT             4  ZA        REAL              COMD
  1600  ZALT      REAL              COMA          1434  ZC        REAL              COMA
  1121  ZCOMP     REAL              COMA             2  ZD        REAL              COMB
    14  ZDDE      REAL              COMB            10  ZDEF      REAL              COMB
  5215  ZDEM      REAL      ARRAY   MANEUV        1364  ZDM       REAL      ARRAY   COMA
  1260  ZDO       REAL              COMA             5  ZDTG      REAL              COMB
 10017  ZDTGM     REAL      ARRAY   MANEUV         541  ZDTGMS    REAL      ARRAY   COMA
    66  ZDTGO     REAL              COMA          1542  ZE        REAL      ARRAY   COMA
    16  ZLOS      REAL              EXTRA            6  ZM        REAL      ARRAY   MISD
 10057  ZPRIME    REAL              MANEUV         455  ZS        REAL
   711  ZT        REAL      ARRAY                 1664  ZTA       REAL              COMA
    11  ZZZ       REAL              COMB

FILE NAMES        MODE
      OUTPUT      FMT

EXTERNALS         TYPE    ARGS
      COS         REAL      1 LIBRARY                 EXP       REAL      1 LIBRARY
      INTERP                7                         SIN       REAL      1 LIBRARY
      SQRT        REAL      1 LIBRARY

INLINE FUNCTIONS  TYPE    ARGS
      FLOAT       REAL      1  INTRIN

STATEMENT LABELS
     0  1                              0  2                          0  3
   230  4                            165  5                        303  10
   312  11                           372  15     FMT                46  19
     0  20                           254  21                       375  25      FMT
   213  30                           403  66     FMT               414  67      FMT
     0  99        INACTIVE             0  102      INACTIVE          0  155

COMMON BLOCKS     LENGTH
      MISD          14
      DELT         300
      MU             6
      COMB          13
      MANEUV      4316
      COMA        1165
      GTARG         11
      COMD           5
      COMP          73
      EXTRA         72

STATISTICS
  PROGRAM LENGTH              7738     507
  CM LABELED COMMON LENGTH  135278    5975
```

```
      SUBROUTINE MEAN(AXM,AYM,AZM,ARM,NR,SX,SY,SZ,SS)
C
C  THIS SUBROUTINE CALCULATES THE MEAN AND STANDARD DEVIATION
C  OF THE MISS DISTANCES
C
      COMMON/COMP/IS1,I99,I88,CLMS(10),CLS1(10),CLS2(10),NSAM,Q1,Q2,Q3,
     *Q4,Q5,Q6,W1,W2,W3,W4,W5,W6,IFT,IPLANE,ICON,S2P1,S1P1,A2P1,A1P1,
     *S2P2,S1P2,A2P2,A1P2,S2P3,S1P3,A2P3,A1P3,S2P4,S1P4,A2P4,A1P4,S2P5,
     *S1P5,A2P5,A1P5,S2P6,S1P6,A2P6,A1P6
      DIMENSION AXM(20),AYM(20),AZM(20),ARM(20)
      XNR=FLOAT(NR)
      XNN= SQRT(XNR/(XNR-1.))
      J=0
C
    9 SS=0.
      SVS=0.
      J=J+1
      DO  18 I=1,NR
      GO TO (11,12,13,14),J
   11 DUM= AXM(I)
      GO TO 15
   12 DUM= AYM(I)
      GO TO 15
   13 DUM= AZM(I)
       GO TO 15
   14 DUM= ARM(I)
   15 SS= SS+DUM
   18 SVS= SVS + DUM*DUM
C
C  MEAN
C
      SS= SS/XNR
      SVS= SVS/XNR
C
C  STANDARD DEVIATION
C
      DOD=SVS-SS*SS
      DODO=ABS(DOD)
      SVS=SQRT(DODO)*XNN
      GO TO (21,22,23,24),J
   21 SX= SS
      SVX= SVS
      GO TO 9
   22 SY= SS
      SVY= SVS
      GO TO 9
   23 SZ= SS
      SVZ= SVS
      GO TO 9
C
   24 PRINT  34
      PRINT  35, SX,SY,SZ,SS
      PRINT  36, SVX,SVY,SVZ,SVS
      IF(I99.NE.1) GO TO 45
      IF(IPLANE.EQ.0) GO TO 45
      IF(IPLANE.EQ.1) GO TO 40
      IF(IPLANE.EQ.2) GO TO 41
```

```
      IF(IPLANE.EQ.3) GO TO 42
   40 IF(SVY.GT.S2P1.OR.SVY.LT.S1P1) IFT=1
      IF(SVZ.GT.S2P2.OR.SVZ.LT.S1P2) IFT=1
      IF(SY.GT.A2P1.OR.SY.LT.A1P1) IFT=1
      IF(SZ.GT.A2P2.OR.SZ.LT.A1P2) IFT=1
      GO TO 45
   41 IF(SVX.GT.S2P3.OR.SVX.LT.S1P3) IFT=1
      IF(SVY.GT.S2P4.OR.SVY.LT.S1P4) IFT=1
      IF(SX.GT.A2P3.OR.SX.LT.A1P3) IFT=1
      IF(SY.GT.A2P4.OR.SY.LT.A1P4) IFT=1
      GO TO 45
   42 IF(SVX.GT.S2P5.OR.SVX.LT.S1P5) IFT=1
      IF(SVZ.GT.S2P6.OR.SVZ.LT.S1P6) IFT=1
      IF(SX.GT.A2P5.OR.SX.LT.A1P5) IFT=1
      IF(SZ.GT.A2P6.OR.SZ.LT.A1P6) IFT=1
   45 CONTINUE
      RETURN
C
   34 FORMAT(/15X2HXT8X2HYT8X2HZT8X2HRM)
   35 FORMAT(/5X4HMEAN4F10.3)
   36 FORMAT(3X6HST DEV4F10.4)
      END
```

```
        SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
      3  MEAN

VARIABLES       SN  TYPE           RELOCATION
      0  ARM        REAL        ARRAY   F.P.             0  AXM       REAL        ARRAY   F.P.
      0  AYM        REAL        ARRAY   F.P.             0  AZM       REAL        ARRAY   F.P.
     64  A1P1       REAL                COMP            70  A1P2      REAL                COMP
     74  A1P3       REAL                COMP           100  A1P4      REAL                COMP
    104  A1P5       REAL                COMP           110  A1P6      REAL                COMP
     63  A2P1       REAL                COMP            67  A2P2      REAL                COMP
     73  A2P3       REAL                COMP            77  A2P4      REAL                COMP
    103  A2P5       REAL                COMP           107  A2P6      REAL                COMP
      3  CLMS       REAL        ARRAY   COMP            15  CLS1      REAL        ARRAY   COMP
     27  CLS2       REAL        ARRAY   COMP           272  DOD       REAL
    273  DOUO       REAL                               271  DUM       REAL
    270  I          INTEGER                             60  ICON      INTEGER             COMP
     56  IFT        INTEGER             COMP            57  IPLANE    INTEGER             COMP
      0  IS1        INTEGER             COMP             2  I88       INTEGER             COMP
      1  I99        INTEGER             COMP           266  J         INTEGER
      0  NR         INTEGER             F.P.            41  NSAM      INTEGER             COMP
     42  Q1         REAL                COMP            43  Q2        REAL                COMP
     44  Q3         REAL                COMP            45  Q4        REAL                COMP
     46  Q5         REAL                COMP            47  Q6        REAL                COMP
      0  SS         REAL                F.P.           267  SVS       REAL
    274  SVX        REAL                               275  SVY       REAL
    276  SVZ        REAL                                 0  SX        REAL                F.P.
      0  SY         REAL                F.P.             0  SZ        REAL                F.P.
     62  S1P1       REAL                COMP            66  S1P2      REAL                COMP
     72  S1P3       REAL                COMP            76  S1P4      REAL                COMP
    102  S1P5       REAL                COMP           106  S1P6      REAL                COMP
     61  S2P1       REAL                COMP            65  S2P2      REAL                COMP
     71  S2P3       REAL                COMP            75  S2P4      REAL                COMP
    101  S2P5       REAL                COMP           105  S2P6      REAL                COMP
     50  W1         REAL                COMP            51  W2        REAL                COMP
     52  W3         REAL                COMP            53  W4        REAL                COMP
     54  W5         REAL                COMP            55  W6        REAL                COMP
    265  XNN        REAL                               264  XNR       REAL

FILE NAMES      MODE
        OUTPUT  FMT

EXTERNALS          TYPE   ARGS
        SQRT       REAL      1 LIBRARY

INLINE FUNCTIONS   TYPE   ARGS
        ABS        REAL      1  INTRIN                    FLOAT    REAL       1  INTRIN

STATEMENT LABELS
     23  9                           43  11                              45  12
     47  13                          51  14                              52  15
      0  18                          77  21                             103  22
    107  23                         113  24                             251  34      FMT
    255  35      FMT                260  36      FMT                    130  40
    155  41                         202  42                             226  45
```

```
COMMON BLOCKS   LENGTH
       COMP         73

STATISTICS
  PROGRAM LENGTH                 321B      209
  CM LABELED COMMON LENGTH       111B       73
```

```
      SUBROUTINE INTERP(X,XT,YT,NX,NPX,Y,NERR)
C     DESCRIPTION
C        THIS ROUTINE USES THE LAGRANGE INTERPOLATION FORMULA TO
C        CALCULATE THE VALUE Y=F(X) FROM THE FUNCTION TABLE (YT(I)=
C        F(XT(I)). THE TABLE OF INDEPENDENT VARIABLES MUST BE IN
C        INCREASING ORDER BUT DO NOT HAVE TO BE EVENLY SPACED. IF THE
C        DESIRED ARGUMENT X IS NOT IN THE INDEPENDENT VARIABLE TABLE,
C        THE ROUTINE WILL EXTRAPOLATE USING THE NEAREST POINTS TO THE
C        UNKNOWN VALUE. THE DEGREE OF THE INTERPOLATION FORMULA IS A
C        VARIABLE AND MAY BE SELECTED BY THE USER.
C     INPUT
C        1  X        THE INDEPENDENT VARIABLE X.
C        2  XT       TABLE OF INDEPENDENT X VALUES. MUST BE IN
C                    INCREASING ORDER.
C        3  YT       TABLE OF DEPENDENT Y VALUES. YT(I)=F(XT(I))
C        4  NX       NUMBER OF POINTS IN XT.
C        5  NPX      NUMBER OF POINTS USED IN THE INTERPOLATING FORMULA
C                    WITH XT AS THE INDEPENDENT VARIABLE TABLE. (NPX-1)
C                    IS THE DEGREE OF THE INTERPOLATION FORMULA USED.
C     OUTPUT
C        1  Y        THE INTERPOLATED DEPENDENT VALUE. Y=F(X)
C        2  NERR     NERR=0 IF XT(1) .LE. X .LE. XT(NX)
C                    NERR = 1 IF X .LT. XT(1)
C                    NERR = 2 IF X .GT. XT(NX)
C
      DIMENSION XT(1),YT(1)
      NERR = 0
      NP=NPX
      IF(NX .LT. NP)   NP = NX
      NS = (NX+169)/26
      IH = NP/2
      I = 1
      IF(XT(I) - X)30,20,10
   10 IH = 0
   12 NERR = 1
      GO TO 70
   13 NERR = 2
      GO TO 70
   20 Y = YT(I)
      GO TO 399
   30 I = NX
      IF(XT(I) - X)13,20,50
   50 L = IH + 1
      IS = NS+L
      IF(NX-IS)58,58,52
   52 DO 54   I=IS,NX,NS
      IF(XT(I) - X)54,20,56
   54 L = I
      GO TO 58
   56 L = I - NS
   58 DO 60   I=L,NX
      IF(XT(I) - X)60,20,70
   60 CONTINUE
   70 K = I - IH
      N = K + NP - 1
      Y = 0.0
      IF (N - NX)90,90,80
```

```
   80 N = NX
      K = NX-NP+1
   90 DO 120  J=K,N
      P = 1.0
      DO 110  I=K,N
      IF (I-J)100,110,100
  100 P = P * (X - XT(I)) / (XT(J) - XT(I))
  110 CONTINUE
  120 Y = Y + YT(J)*P
  999 RETURN
      END
```

```
         SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  INTERP

VARIABLES        SN  TYPE             RELOCATION
   154  I            INTEGER                                  153  IH         INTEGER
   156  IS           INTEGER                                  161  J          INTEGER
   157  K            INTEGER                                  155  L          INTEGER
   160  N            INTEGER                                    0  NERR       INTEGER              F.P.
   151  NP           INTEGER                                    0  NPX        INTEGER              F.P.
   152  NS           INTEGER                                    0  NX         INTEGER              F.P.
   162  P            REAL                                       0  X          REAL                 F.P.
     0  XT           REAL           ARRAY      F.P.             0  Y          REAL                 F.P.
     0  YT           REAL           ARRAY      F.P.

STATEMENT LABELS
     0  10             INACTIVE                  0  12           INACTIVE               37  13
    41  20                                      45  30                                   0  50           INACTIVE
     0  52             INACTIVE                  0  54                                  72  56
    74  58                                       0  60                                 106  70
     0  80             INACTIVE                117  90                                   0  100          INACTIVE
   135  110                                      0  120                                145  999

STATISTICS
  PROGRAM LENGTH                 2048     132
```

```
      SUBROUTINE FLIGHT
      INTEGER PIN(4),POUT(4),SL5,SL0
      REAL MAN,MISS,MISSED
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,
     *RI,GAM,EDOT,THETAL,RN,PPX(50),PPY(50),PPZ(50),TIME(50),TS(30),
     *XDTGMS(30),YDTGMS(30),ZDTGMS(30),MAN(4,50),MISSED(7),NT,XCOMP,
     *YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG,XDO,YDO,ZDO,DXG,DYG,
     *DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),RLBK,SCALEP,F1,F2,F3,G1,
     *G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,CPL,A1,VTI,XE(30),YE(30),
     *ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),PHO,ARG,AAA,SCALET,TREAL,
     *TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM,SA,CA,VMX(50),VMY(50),
     *VMZ(50),ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/COMM/NPATH,LOOP1,LOOP2,DASF(11),ADSF(10),INFLRT,LTMAX
      COMMON/*ADC1/2,
     *IADIN1,IADIN2,IADIN3,IADIN4,IADIN5,IADIN6,
     *IADIN7,IADIN8,IADIN9,IADIN10
      COMMON/*IDIS2/IIN
      JAN,ON
      COMMON/*DAC1/49,
     *DAOUT1,DAOUT2,DAOUT3,DAOUT4,DAOUT5,DAOUT6,
     *DAOUT7,DAOUT8,DAOUT9,DAOUT10,DAOUT11
      COMMON/*ODIS2/IOUT
      JAN,OFF
      NAMELIST/TEST/LEVEL,IPTS,XXS,XDTGO,YDTGO,ZDTGO,RLB,COSE,SPO,
    $
     1RI,GAM,EDOT,THETAL,RN,PPX,PPY,PPZ,TIME,TS,
     2XDTGMS,YDTGMS,ZDTGMS,MAN,MISSED,NT,XCOMP,
     3YCOMP,ZCOMP,TAMA,DELTAR,VM,G,GGG,XDO,YDO,ZDO,DXG,DYG,
     4DZG,S2,S3,S4,S5,XDM,YDM,ZDM,RLBK,SCALEP,F1,F2,F3,G1,
     5G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,CPL,A1,VTI,XE,YE,
     6ZE,ZALT,NERR,CLA,NPX,NX,CLAA,PHO,ARG,AAA,SCALET,TREAL,
     7TMA,XTA,YTA,ZTA,SCALEV,QMM,QM,SA,CA,VMX,VMY,
     8VMZ,ECOS,HR7EE,FI7T,FCI77,
     9NPATH,LOOP1,LOOP2,DASF,ADSF,INFLRT,LTMAX
C
C     CHECK AND PRINT TRUNK SET-UP
C
      PIN(1)=3RV13
      PIN(2)=3RV15
      PIN(3)=3RV60
      PIN(4)=3RV61
      LEN=4
      CALL PATSTAT(PIN,POUT,LEN)
      WRITE(6,1000) (PIN(I),POUT(I),I=1,4)
C
C     SAVE INITIAL CONDITIONS FOR RESTARTING PROGRAM
C
      SAVE1=XDTGO
      SAVE2=YDTGO
      SAVE3=ZDTGO
      SAVE4=RLB
      SAVE5=COSE
      SAVE6=      SPO
      SAVE7=RI
      SAVE8=GAM
      SAVE9=EDOT
      SAVE10=THETAL
```

```
      SAVE11=RN
C
C         RESERVE HYBRID EQUIPMENT
C
    5 PAUSE"GO TO RESERVE HYBRID EQUIPMENT"
      CALL RESERVE(IERR)
      WRITE(6,2000) IERR
      IF(IERR.NE.0)GO TO 5
C
C         PRE REAL TIME INITIALIZATION
C
      NPATH=1
      LOOP1=0
      LOOP2=0
      INFLRT=-1
      LTMAX=0
      LEVEL=-7
C
      XDTGO=SAVE1
      YDTGO=SAVE2
      ZTDGO=SAVE3
      RLB  =SAVE4
      COSE =SAVE5
      SPO  =SAVE6
      RI   =SAVE7
      GAM  =SAVE8
      EDOT =SAVE9
      THETAL=SAVE10
      RN=SAVE11
C
C         INITIALIZATION OF DIGITAL TO ANALOG SCALE FACTORS
C
      DASF(1)=1./20000.
      DASF(2)=1./20000.
      DASF(3)=1./20000.
      DASF(4)=1./100.
      DASF(5)=1./10.
      DASF(6)=1./100.
      DASF(7)=1./200000.
      DASF(8)=1./100.
      DASF(9)=1./60.
      DASF(10)=1./1000.
      DASF(11)=1./1000.
C
C         INITIALIZATION OF ANALOG TO DIGITAL SCALE FACTORS
C
      ADSF(1)=2000.
      ADSF(2)=2000.
      ADSF(3)=2000.
      ADSF(4)=10.
      ADSF(5)=20000.
      ADSF(6)=20000.
      ADSF(7)=20000.
      ADSF(8)=20000.
      ADSF(9)=20000.
      ADSF(10)=20000.
C
```

```
      C        JAM ALL CONTROL LINES LOW
      C
            IOUT=0
      C
      C        DO NOT PROCEED UNTIL SENSE LINE 5 IS HIGH
      C
            LARA=1
         10 CALL INTCNVT(LARA,1)
            SL5=IIN.AND.32
            IF(SL5.NE.0) GO TO 20
            PAUSE "WAIT FOR SENSE LINE 5 HIGH"
            GO TO 10
      C
      C        INITIAL CONDITIONS TO ANALOG
      C
         20 DAOUT1=XDTGO*DASF(1)
            DAOUT2=YDTGO*DASF(2)
            DAOUT3=ZDTGO*DASF(3)
            DAOUT4=RLB*DASF(4)
            DAOUT5=COSE*DASF(5)
            DAOUT6=SPO*DASF(6)
            DAOUT7=RT*DASF(7)
            DAOUT8=GAM*DASF(8)
            DAOUT9=EDOT*DASF(9)
            DAOUT10=THETAL*DASF(10)
            DAOUT11=RN*DASF(11)
      C
      C        SET CONTROL LINE 4 HIGH
      C        PAUSE UNTIL TIME TO ENTER REAL TIME
      C
            IOUT=16
            PAUSE "GO TO ENTER REAL TIME"
            CALL SIMRUN(ISTAT)
            WRITE(6,3000) ISTAT
            WRITE(6,TEST)
            CALL SHOLD
            WRITE(6,TEST)
      C
      C        SET SENSE LINE 0 LOW TO RESTART A BAD RUN
      C
            LARA=1
            PAUSE"SET SENSE LINE 0 LOW TO RESTART A BAD RUN"
            CALL INTCNVT(LARA,1)
            SL0=IIN.AND.1
            IF(SL0.EQ.0) GO TO 5
      C
      C        RETURN TO MAIN PROGRAM WHEN FLIGHT IS OVER
      C
            WRITE(6,4000) LOOP1
            WRITE(6,5000) LOOP2
            LTMAX=10*LTMAX
            WRITE(6,11000) LTMAX
            RETURN
      C
      C        FORMAT STATEMENTS
      C
       1000 FORMAT(1H1,/////,* TRUNK LINE PATCHING IS *,4(/,10X,R3,* TO *,R3))
```

```
 2000 FORMAT(//,* RESERVATION ERROR CODE = *,O20)
 3000 FORMAT(//,* REAL TIME STATUS = *,O20)
 4000 FORMAT(//,* WAIT LOOP EXECUTED *,I8,* TIMES *)
 5000 FORMAT(//,* REAL TIME LOOP EXECUTED *,I8,* TIMES *)
11000 FORMAT(//,* MAXIMUM LOOP TIME = *,I5,* MICROSECONDS *)
      END
```

```
        SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1   FLIGHT

VARIABLES      SN  TYPE              RELOCATION
   1621  AAA       REAL                 COMA            16  ADSF      REAL        ARRAY     COMM
   1620  ARG       REAL                 COMA           672  ASDF      REAL
   1444  A1        REAL                 COMA          1702  CA        REAL                  COMA
   1602  CLA       REAL                 COMA          1605  CLAA      REAL        ARRAY     COMA
     70  COSE      REAL                 COMA          1443  CPL       REAL                  COMA
   1441  CTL       REAL                 COMA        502160  DAOUT1    REAL
 502171  DAOUT10   REAL                             502172  DAOUT11   REAL
 502161  DAOUT2    REAL                             502162  DAOUT3    REAL
 502163  DAOUT4    REAL                             502164  DAOUT5    REAL
 502165  DAOUT6    REAL                             502166  DAOUT7    REAL
 502167  DAOUT8    REAL                             502170  DAOUT9    REAL
      3  DASF      REAL        ARRAY    COMM          1160  DELTAR    REAL        ARRAY     COMA
   1251  DXG       REAL                 COMA          1262  DYG       REAL                  COMA
   1263  DZG       REAL                 COMA          2131  ECOS      REAL        ARRAY     COMA
     74  EDOT      REAL                 COMA          2204  FCI77     REAL        ARRAY     COMA
   2173  FI7T      REAL        ARRAY    COMA          1424  F1        REAL                  COMA
   1425  F2        REAL                 COMA          1426  F3        REAL                  COMA
   1254  G         REAL                 COMA            73  GAM       REAL                  COMA
   1255  GGG       REAL                 COMA          1427  G1        REAL                  COMA
   1430  G2        REAL                 COMA          1431  G3        REAL                  COMA
   2152  HR7EE     REAL        ARRAY    COMA           674  I         INTEGER
 504001  IADIN1    INTEGER                          504012  IADIN10   INTEGER
 504002  IADIN2    INTEGER                          504003  IADIN3    INTEGER
 504004  IADIN4    INTEGER                          504005  IADIN5    INTEGER
 504006  IADIN6    INTEGER                          504007  IADIN7    INTEGER
 504010  IADIN8    INTEGER                          504011  IADIN9    INTEGER
    710  IERR      INTEGER                          514000  IIN       INTEGER
     39  INFLRT    INTEGER              COMM        516100  IOUT      INTEGER
      1  INFO      INTEGER              COMA           713  ISTAT     INTEGER
    712  LARA      INTEGER                             673  LEN       INTEGER
      0  LEVSL     INTEGER              COMA             1  LOOP1     INTEGER               COMM
      2  LOOP2     INTEGER              COMM            31  LTMAX     INTEGER               COMM
    577  MAN       REAL        ARRAY    COMA           671  MISS      REAL        *UNDEF
   1107  MISSED    REAL        ARRAY    COMA          1601  NERR      INTEGER               COMA
      0  NPATH     INTEGER              COMM          1603  NPX       INTEGER               COMA
   1116  NT        INTEGER              COMA          1604  NX        INTEGER               COMA
   1617  PHO       REAL                 COMA           714  PIN       INTEGER     ARRAY
    720  POUT      INTEGER     ARRAY                    77  PPX       REAL        ARRAY     COMA
    161  PPY       REAL        ARRAY    COMA           243  PPZ       REAL        ARRAY     COMA
   1700  RM        REAL                 COMA          1666  RMM       REAL        ARRAY     COMA
     72  RI        REAL                 COMA            67  RLB       REAL                  COMA
   1422  RLBK      REAL                 COMA            76  RN        REAL                  COMA
   1436  RRR       REAL                 COMA          1701  SA        REAL                  COMA
    575  SAVE1     REAL                                706  SAVE10    REAL
    707  SAVE11    REAL                                676  SAVE2     REAL
    577  SAVE3     REAL                                700  SAVE4     REAL
    701  SAVE5     REAL                                702  SAVE6     REAL
    703  SAVE7     REAL                                704  SAVE8     REAL
    705  SAVE9     REAL                               1423  SCALEP    REAL                  COMA
   1522  SCALET    REAL                 COMA          1665  SCALEV    REAL                  COMA
    570  SL0       INTEGER                             667  SL5       INTEGER
```

```
VARIABLES     SN  TYPE            RELOCATION
  1440  SPL         REAL                COMA          71  SPO         REAL                COMA
  1437  SR          REAL                COMA        1442  STL         REAL                COMA
  1435  S1          REAL                COMA        1264  S2          REAL                COMA
  1265  S3          REAL                COMA        1266  S4          REAL                COMA
  1267  S5          REAL                COMA        1122  TAMA        REAL      ARRAY     COMA
    75  THETAL      REAL                COMA         325  TIME        REAL      ARRAY     COMA
  1624  TMA         REAL      ARRAY     COMA        1623  TREAL       REAL                COMA
   407  TS          REAL      ARRAY     COMA        1216  VM          REAL      ARRAY     COMA
  1703  VMX         REAL      ARRAY     COMA        1765  VMY         REAL      ARRAY     COMA
  2047  VMZ         REAL      ARRAY     COMA        1445  VTI         REAL                COMA
  1432  XC          REAL                COMA        1117  XCOMP       REAL                COMA
  1270  XDM         REAL      ARRAY     COMA        1256  XDO         REAL                COMA
   445  XDTGMS      REAL      ARRAY     COMA          64  XDTGO       REAL                COMA
  1446  XE          REAL      ARRAY     COMA        1662  XTA         REAL                COMA
     2  XXS         REAL      ARRAY     COMA        1433  YC          REAL                COMA
  1120  YCOMP       REAL                COMA        1326  YDM         REAL      ARRAY     COMA
  1257  YDO         REAL                COMA         503  YDTGMS      REAL      ARRAY     COMA
    65  YDTGO       REAL                COMA        1504  YE          REAL      ARRAY     COMA
  1663  YTA         REAL                COMA        1600  ZALT        REAL                COMA
  1434  ZC          REAL                COMA        1121  ZCOMP       REAL                COMA
  1364  ZDM         REAL      ARRAY     COMA        1260  ZDO         REAL                COMA
   541  ZDTGMS      REAL      ARRAY     COMA          66  ZDTGO       REAL                COMA
  1542  ZE          REAL      ARRAY     COMA        1664  ZTA         REAL                COMA
   711  ZTDGO       REAL

FILE NAMES        MODE
       TAPE6      MIXED

EXTERNALS           TYPE   ARGS
       BHOLD                 0                   INTCNVT              2
       PATSTAT               3                   RESERVE              1
       SIMRUN                1

NAMELISTS
       TEST

STATEMENT LABELS
    44  5                              125  10                             134  20
   611  1000   FMT                     620  2000   FMT                     625  3000   FMT
   632  4000   FMT                     640  5000   FMT                     646  11000  FMT

COMMON BLOCKS   LENGTH
       COMA       1165
       COMM         26

STATISTICS
  PROGRAM LENGTH             746B      486
  CM LABELED COMMON LENGTH  2247B     1191
```

```
      SUBROUTINE REALT
      INTEGER WMAN,SL6
      REAL MAN,MISS,MISSED
      COMMON/COMA/LEVEL,IPTS,XXS(50),XDT50,YDTGO,ZDTGO,RLB,COSE,SPO,
     *RI,GAM,EDOT,THETAL,RN,PPX(50),PPY(50),PPZ(50),TIME(50),TS(30),
     *XDTGMS(30),YDTGMS(30),ZDTGMS(30),MAN(4,50),MISSED(7),NT,XCOMP,
     *YCOMP,ZCOMP,TAMA(30),DELTAR(30),VM(30),G,GGG,XDO,YDO,ZDO,DXG,DYG,
     *DZG,S2,S3,S4,S5,XDM(30),YDM(30),ZDM(30),RLBK,SCALEP,F1,F2,F3,G1,
     *G2,G3,XC,YC,ZC,S1,RRR,SR,SPL,CTL,STL,CPL,A1,VTI,XE(30),YE(30),
     *ZE(30),ZALT,NERR,CLA,NPX,NX,CLAA(10),PHO,ARG,AAA,SCALET,TREAL,
     *TMA(30),XTA,YTA,ZTA,SCALEV,QMM(10),QM,SA,CA,VMX(50),VMY(50),
     *VMZ(50),ECOS(17),HR7EE(17),FI7T(9),FCI77(9)
      COMMON/COMM/NPATH,LOOP1,LOOP2,DASF(11),ADSF(10),INFLRT,LTMAX
      COMMON/*ADC172,
     *IADIN1,IADIN2,IADIN3,IADIN4,IADIN5,IADIN6,
     *IADIN7,IADIN8,IADIN9,IADIN10
      COMMON/*IDIS2/IIN
      JAM,ON
      COMMON/*DAC1/49,
     *DAOUT1,DAOUT2,DAOUT3,DAOUT4,DAOUT5,DAOUT6,
     *DAOUT7,DAOUT8,DAOUT9,DAOUT10,DAOUT11
      COMMON/*ODIS2/IOUT
      JAM,OFF
      DATA MASK/37777777B/
C
C     ABNORMAL ABORT IF SENSE LINE 15 IS HIGH
C
      SL15=IIN.AND.2**15
      IF(SL15.NE.0)GO TO 100
C
C          NPATH=1 -- WAITING FOR SENSE LINE 6 TO COME HIGH
C          NPATH=2 -- FLIGHT IN PROGRESS
C
      GO TO (10,20),NPATH
C
C          INITIALIZATION OF FLAGS AND INDICES
C
   10 IF(INFLRT.GT.0) GO TO 15
      INFLRT=1
      III=1
      INDEX=1
      KSK=-1
      ADSF1=ADSF(1)
      ADSF2=ADSF(2)
      ADSF3=ADSF(3)
      ADSF8=ADSF(8)
      ADSF9=ADSF(9)
      ADSF10=ADSF(10)
      NL1=0
      NL2=0
      NL3=0
      NL4=0
      NL5=0
      NL6=0
      IOUT=2**15+2**4
C
C          BEGIN FLIGHT IF SENSE LINE 6 IS HIGH
```

AD-A052 676 B-K DYNAMICS INC ROCKVILLE MD F/G 9/2
SUMMARY REPORT OF STINGER CONVERSION ACTIVITIES. (U)
JUL 76 DAAH01-75-C-0194
UNCLASSIFIED BKD-TR-3-206 NL

4 OF 4
AD
A052676

END
DATE
FILMED
5-78
DDC

```
C
   15 SL6=IIN.AND.64
      IF(SL6.NE.0) NPATH=2
      LOOP1=LOOP1+1
      CALL SIMIDLE
C*****************************************************************************
C                                                                            *
C         REAL TIME LOOP                                                     *
C                                                                            *
C*****************************************************************************
   20 HMAN=0
      LOOP2=LOOP2+1
C
C         READ TIME FROM ANALOG
C
      DT=HWFLOT(IADIN4)*ADSF(4)
C
C         COMPUTE VARIABLE SCALE FACTORS UNLESS THEY HAVE REACHED
C         CONSTANCY
C
      IF(KCK.GT.0) GO TO 30
      IF(DT.LE.G) SKK=GGG*DT/G+1.
      IF(DT.GT.G) SKK=GGG+1.
      IF(DT.GT.G) KCK=1
      ADSF(1)=ADSF1/SKK
      ADSF(2)=ADSF2/SKK
      ADSF(3)=ADSF3/SKK
      ADSF(8)=ADSF8/SKK
      ADSF(9)=ADSF9/SKK
      ADSF(10)=ADSF10/SKK
C
C         READ REMAINING VARIABLES FROM ANALOG
C
   30 DX=HWFLOT(IADIN1)*ADSF(1)
      DY=HWFLOT(IADIN2)*ADSF(2)
      DZ=HWFLOT(IADIN3)*ADSF(3)
      XDOT=HWFLOT(IADIN5)*ADSF(5)
      YDOT=HWFLOT(IADIN6)*ADSF(6)
      ZDOT=HWFLOT(IADIN7)*ADSF(7)
      XXX =HWFLOT(IADIN8)*ADSF(8)
      YYY =HWFLOT(IADIN9)*ADSF(9)
      ZZZ=HWFLOT(IADIN10)*ADSF(10)
C
C         STORE POSITION AND RATE
C
      DXG=DX
      DYG=DY
      DZG=DZ
      XDD=XDOT
      YDD=YDOT
      ZDD=ZDOT
C
C         IF DX HAS REACHED A RANGE TABLE ENTRY, STORE DATA
C
      IF(DX.LT.XXS(INDEX)) GO TO 40
      PPX(INDEX)=DX
      PPY(INDEX)=DY
```

```
      PPZ(INDEX)=DZ
      TIME(INDEX)=DT
      VMX(INDEX)=XDOT
      VMY(INDEX)=YDOT
      VMZ(INDEX)=ZDOT
      MMAN=7
C
C        IF TIME IS GREATER THAN TPRIME, CHECK FOR MISS
C
   40 IF(DT.LE.G) GO TO 50
      MISS=XDOT*DX+YDOT*DY+ZDOT*DZ
C
C        IF MISSILE HAS MISSED TARGET, STORE THE ASSOCIATED VALUES
C        AND TERMINATE
C
      IF(MISS.LE.0) GO TO 50
      MISSED(1)=DX
      MISSED(2)=DY
      MISSED(3)=DZ
      MISSED(4)=XDOT
      MISSED(5)=YDOT
      MISSED(6)=ZDOT
      MISSED(7)=MISS
      GO TO 100
C
C        IF TARGET TRAJECTORY TABLE HAS BEEN EXCEEDED OR TARGET
C        MANEUVER HAS NOT YET BEGUN, END LOOP
C
   50 IF(LEVEL.GT.0) CALL SIMIDLE
      IF(DT.LT.TS(1)) CALL SIMIDLE
      LEVEL=0
C
C        FIND POSITION IN TARGET TRAJECTORY TABLE FOR INTERPOLATION
C
   60 IT2=IT1+1
      IF(DT.LT.TS(IT2)) GO TO 70
      IT1=IT1+1
      IF((IT1.LT.NT).AND.(IT1.LT.30)) GO TO 60
C
C        SET INDICATOR FOR TARGET TRAJECTORY TABLE EXCEEDED AND END
C        THIS LOOP
C
      LEVEL=7
      CALL SIMIDLE
C
C        INTERPOLATE TARGET MANEUVER
C
   70 DIV=TS(IT2)-TS(IT1)
      RATIO=(DT-TS(IT1))/DIV
      XCOMP=XDTGMS(IT1)+RATIO*(XDTGMS(IT2)-XDTGMS(IT1))
      XC=XDM(IT1)+RATIO*(XDM(IT2)-XDM(IT1))
      YCOMP=YDTGMS(IT1)+RATIO*(YDTGMS(IT2)-YDTGMS(IT1))
      YC=YDM(IT1)+RATIO*(YDM(IT2)-YDM(IT1))
      ZCOMP=ZDTGMS(IT1)+RATIO*(ZDTGMS(IT2)-ZDTGMS(IT1))
      ZC=ZDM(IT1)+RATIO*(ZDM(IT2)-ZDM(IT1))
C
C        COMPUTATION OF TARGET INERTIAL VELOCITY
```

```
      C
            VTI=SQRT(XC*XC+YC*YC+ZC*ZC)
      C
      C         CHECK FOR HELICOPTER
      C
            IF(VTI.LT.338.0) GO TO 80
      C
      C         COMPUTATION OF COSE
      C
            AAA=.003394*ZALT+1116.89
            QM=VTI/AAA
            NX=8
            CALL LINTRP(QM,QMM,CLAA,NX,NL1,RA1,CLA,NER1)
            CALL LINTRP(DT,TMA,XE,NT,NL2,RA2,XTA,NER2)
            CALL LINTRP(DT,TMA,YE,NT,NL3,RA3,YTA,NER3)
            CALL LINTRP(DT,TMA,ZE,NT,NL4,RA4,ZTA,NER4)
            PHO=.00237692*EXP(.00003*ZALT)
            TEMPN=.01745329*4.637084242*SQRT(XTA*XTA+YTA*YTA+ZTA*ZTA)
            TEMPD=PHO*VTI*VTI*CLA
            A1=TEMPN/TEMPD
            SA=SIN(A1)
            CA=COS(A1)
            RFEET=SQRT(XXX*XXX+YYY*YYY+ZZZ*ZZZ)
            RRR=VTI*RFEET
            F1=S2*XXX-SPL*YYY+S3*ZZZ
            F2=S4*XXX+CPL*YYY+S5*ZZZ
            F3=CTL*ZZZ-STL*XXX
            SR=SQRT(XC*XC+YC*YC)
            S1=CA+(SA/SR)*ZC
            G1=S1*XC
            G2=S1*YC
            G3=CA*ZC-SA*SR
            COSE=(F1*G1+F2*G2+F3*G3)/RRR
      C
      C         COMPUTATION OF RLB
      C
            RLB=RLBK*SQRT(1.-COSE*COSE)
      C
      C         COMPUTATION OF RN
      C
            GO TO 75
            NX=17
            CALL LINTRP(COSE,ECOS,HR7EE,NX,NL5,RA5,HR7E,NER5)
            TEMP=-2.341*ALOG(RFEET/22965.831)
            HC7FT=1209.675*EXP(TEMP)*HR7E
            P1IRSS=2.*ATAN(.5/RLB)
            P2IRSS=22.5*RLB/RFEET
            TEMPN=SIN(P1IRSS)*P2IRSS**2
            TEMPD=2.*COS(P1IRSS/2.)**2
            AT7=TEMPN/TEMPD
            PJTU1=EXP(1.003258*ALOG(AT7))/10.
            FI7=HC7FT/PJTU1
            NX=9
            CALL LINTRP(FI7,FI7T,FCI77,NX,NL5,RA6,FCI7,NER6)
            RN=FCI7
         75 CONTINUE
      C
```

```
      C         COMPUTATION OF SPO
      C
            RC1=F2/SQRT(F1*F1+F2*F2)
            RCB=ACOS(RC1)
            RCX=-RC1
            RCY=-SIN(RCB)
            IF(F1.GE.0) RCY=-RCY
            F11=(F2*G3-F3*G2)/VTI
            F22=(F3*G1-F1*G3)/VTI
            F33=(F1*G2-F2*G1)/VTI
            FCR=SQRT(F11*F11+F22*F22+F33*F33)
            G11=F11*RCX
            G22=F22*RCY
            C111=(G11+G22)/FCR
            T111=ACOS(C111)
            IF(F33.LT.0.) TRP=1.570796326-T111
            IF((F33.GE.0.).AND.(T111.LE.1.570796326)) TRP=1.570796326+T111
            IF((F33.GE.0.).AND.(T111.GT.1.570796326)) TRP=T111-4.71238898
            SPO=TRP
      C
      C         STORE TARGET DATA IF A RANGE TABLE ENTRY WAS REACHED THIS LOOP
      C
         80 IF(MMAN.EQ.0) GO TO 90
            IF(INDEX.GT.50) GO TO 90
            MAN(1,INDEX)=DT
            MAN(2,INDEX)=XCOMP
            MAN(3,INDEX)=YCOMP
            MAN(4,INDEX)=ZCOMP
            INDEX=INDEX+1
            IF(INDEX.GT.IPTS) GO TO 100
      C
      C         IF DATA COLLECTION IS NOT COMPLETE, SEND VARIABLES TO ANALOG
      C         AND END THIS LOOP
      C
         90 DAOUT1=XCOMP*DASF(1)
            DAOUT2=YCOMP*DASF(2)
            DAOUT3=ZCOMP*DASF(3)
            DAOUT4=RLB*DASF(4)
            DAOUT5=COSE*DASF(5)
            DAOUT6=SPO*DASF(5)
            DAOUT11=RN*DASF(11)
            LTC=200-STAT(MASK)
            IF(LTC.GT.LTMAX) LTMAX=LTC
            CALL SIMIDLE
      C
      C         SET CONTROL LINE 7 HIGH AND TERMINATE REAL TIME
      C
        100 IOUT=128
            CALL SIMSTOP
            END
```

```
      SUBROUTINE REALT       74/74    OPT=1                          FTNH 4.2+75348        01/12/75  14.31.39.        PAGE     5

   CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

      213      I                THERE IS NO PATH TO THIS STATEMENT.
```

```
SUBROUTINE REALT       74/74    OPT=1                          FTNH 4.2+75348        01/12/76  14.31.39.        PAGE     7

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1  REALT

VARIABLES       SN  TYPE             RELOCATION
  1621  AAA         REAL                    COMA        16  ADSF        REAL        ARRAY    COMM
   722  ADSF1       REAL                               727  ADSF10      REAL
   723  ADSF2       REAL                               724  ADSF3       REAL
   725  ADSF8       REAL                               726  ADSF9       REAL
  1620  ARG         REAL                    COMA       776  AT7         REAL
  1444  A1          REAL                    COMA      1702  CA          REAL                 COMA
  1602  CLA         REAL                    COMA      1605  CLAA        REAL        ARRAY    COMA
    70  COSE        REAL                    COMA      1443  CPL         REAL                 COMA
  1441  CTL         REAL                    COMA      1016  C111        REAL
502150  DAOUT1      REAL                            502171  DAOUT10     REAL
502172  DAOUT11     REAL                            502161  DAOUT2      REAL
502162  DAOUT3      REAL                            502163  DAOUT4      REAL
502164  DAOUT5      REAL                            502165  DAOUT6      REAL
502166  DAOUT7      REAL                            502167  DAOUT8      REAL
502170  DAOUT9      REAL                                 3  DASF        REAL        ARRAY    COMM
  1150  DELTAR      REAL            ARRAY   COMA       752  DIV         REAL
   736  DT          REAL                               740  DX          REAL
  1251  DXG         REAL                    COMA       741  DY          REAL
  1252  DYG         REAL                    COMA       742  DZ          REAL
  1253  DZG         REAL                    COMA      2131  ECOS        REAL        ARRAY    COMA
    74  EDOT        REAL                    COMA      1002  FCI7        REAL
  2204  FCI77       REAL            ARRAY   COMA      1013  FCR         REAL
  1000  FI7         REAL                              2173  FI7T        REAL        ARRAY    COMA
  1424  F1          REAL                    COMA      1010  F11         REAL
  1425  F2          REAL                    COMA      1011  F22.        REAL
  1426  F3          REAL                    COMA      1012  F33         REAL
  1254  G           REAL                    COMA        73  GAM         REAL                 COMA
  1255  GGG         REAL                    COMA      1427  G1          REAL                 COMA
  1014  G11         REAL                              1430  G2          REAL                 COMA
  1015  G22         REAL                              1431  G3          REAL                 COMA
   773  HR7FT       REAL                               770  HR7E        REAL
  2152  HR7EE       REAL            ARRAY   COMA    504001  IADIN1      INTEGER
504012  IADIN10     INTEGER                         504002  IADIN2      INTEGER
504003  IADIN3      INTEGER                         504004  IADIN4      INTEGER
504005  IADIN5      INTEGER                         504006  IADIN6      INTEGER
504007  IADIN7      INTEGER                         504010  IADIN8      INTEGER
504011  IADIN9      INTEGER                         514000  IIN         INTEGER
   720  INDEX       INTEGER                             30  INFLRT      INTEGER              COMM
516100  IOUT        INTEGER                              1  IPTS        INTEGER              COMA
   717  IT1         INTEGER                            751  IT2         INTEGER
   721  KCK         INTEGER                              0  LEVEL       INTEGER              COMA
     1  LOOP1       INTEGER                 COMM         2  LOOP2       INTEGER              COMM
  1021  LTC         INTEGER                             31  LTMAX       INTEGER              COMM
   577  MAX         REAL            ARRAY   COMA       667  MASK        INTEGER
   715  MISS        REAL                              1107  MISSED      REAL        ARRAY    COMA
  1601  NERR        INTEGER                 COMA       755  NER1        INTEGER
   757  NER2        INTEGER                            761  NER3        INTEGER
   753  NER4        INTEGER                            771  NER5        INTEGER
  1003  NER6        INTEGER                            730  NL1         INTEGER
   731  NL2         INTEGER                            732  NL3         INTEGER
   733  NL4         INTEGER                            734  NL5         INTEGER
```

```
SUBROUTINE REALT       74/74    OPT=1                          FTNH 4.2+75348      01/12/76  14.31.39.       PAGE     8

VARIABLES      SN  TYPE             RELOCATION
   735  NL6       INTEGER                          0  NPATH     INTEGER              COMM
  1603  NPX       INTEGER           COMA        1115  NT        INTEGER              COMA
  1604  NX        INTEGER           COMA        1617  PHO       REAL                 COMA
   777  PJTOT     REAL                            77  PPX       REAL       ARRAY     COMA
   151  PPY       REAL      ARRAY   COMA         243  PPZ       REAL       ARRAY     COMA
   774  P1IRSS    REAL                           775  P2IRSS    REAL
  1700  RM        REAL              COMA        1666  RMM       REAL       ARRAY     COMA
   753  RATIO     REAL                           754  RA1       REAL
   756  RA2       REAL                           760  RA3       REAL
   752  RA4       REAL                           767  RA5       REAL
  1001  RA6       REAL                          1005  RC3       REAL
  1006  RCX       REAL                          1007  RCY       REAL
  1004  RC1       REAL                           766  RFEET     REAL
    72  RI        REAL              COMA          67  RLB       REAL                 COMA
  1422  RLBK      REAL              COMA          76  RN        REAL                 COMA
  1435  RPR       REAL              COMA        1701  SA        REAL                 COMA
  1423  SCALEP    REAL              COMA        1622  SCALET    REAL                 COMA
  1655  SCALEV    REAL              COMA         737  SKK       REAL
   716  SL15      REAL                           714  SL6       INTEGER
  1440  SPL       REAL              COMA          71  SPO       REAL                 COMA
  1437  SR        REAL              COMA        1442  STL       REAL                 COMA
  1435  S1        REAL              COMA        1264  S2        REAL                 COMA
  1265  S3        REAL              COMA        1266  S4        REAL                 COMA
  1267  S5        REAL              COMA        1122  TAMA      REAL       ARRAY     COMA
   772  TEMP      REAL                           765  TEMPD     REAL
   754  TEMPN     REAL                            75  THETAL    REAL                 COMA
   325  TIME      REAL      ARRAY   COMA        1624  TMA       REAL       ARRAY     COMA
  1523  TREAL     REAL              COMA        1020  TRP       REAL
   407  TS        REAL      ARRAY   COMA        1017  T111      REAL
  1215  VM        REAL      ARRAY   COMA        1703  VMX       REAL       ARRAY     COMA
  1755  VMY       REAL      ARRAY   COMA        2047  VMZ       REAL       ARRAY     COMA
  1445  VTI       REAL              COMA         713  WMAN      INTEGER
  1432  XC        REAL              COMA        1117  XCOMP     REAL                 COMA
  1273  XDM       REAL      ARRAY   COMA        1256  XDO       REAL                 COMA
   743  XDOT      REAL                           445  XDTGMS    REAL       ARRAY     COMA
    84  XDTGO     REAL              COMA        1446  XE        REAL       ARRAY     COMA
  1652  XTA       REAL              COMA           2  XXS       REAL       ARRAY     COMA
   746  XXX       REAL                          1433  YC        REAL                 COMA
  1120  YCOMP     REAL              COMA        1326  YDM       REAL       ARRAY     COMA
  1257  YDO       REAL              COMA         744  YDOT      REAL
   503  YDTGMS    REAL      ARRAY   COMA          65  YDTGO     REAL                 COMA
  1504  YE        REAL      ARRAY   COMA        1663  YTA       REAL                 COMA
   747  YYY       REAL                          1600  ZALT      REAL                 COMA
  1434  ZC        REAL              COMA        1121  ZCOMP     REAL                 COMA
  1354  ZDM       REAL      ARRAY   COMA        1260  ZDO       REAL                 COMA
   745  ZDOT      REAL                           541  ZDTGMS    REAL       ARRAY     COMA
    66  ZDTGO     REAL              COMA        1542  ZE        REAL       ARRAY     COMA
  1654  ZTA       REAL              COMA         750  ZZZ       REAL

 EXTERNALS           TYPE    ARGS
         ACOS       REAL      1 LIBRARY                     ALOG      REAL      1 LIBRARY
         ATAN       REAL      1 LIBRARY                     COS       REAL      1 LIBRARY
         EXP        REAL      1 LIBRARY                     HWFLOT    REAL      1
         LINTRP               8                             SIMIDLE             0
         SIMSTOP              0                             SIN       REAL      1 LIBRARY
         SQRT       REAL      1 LIBRARY
```

```
INLINE FUNCTIONS   TYPE   ARGS
       STAT       NO TYPE   1  INTRIN

STATEMENT LABELS
   14  10                    37  15                    46  20
  102  30                   164  40                   205  50
  214  60                   225  70                   430  75
  513  80                   525  90                   552 100

COMMON BLOCKS   LENGTH
       COMA       1165
       COMM         26

STATISTICS
  PROGRAM LENGTH              1022B     530
  CM LABELED COMMON LENGTH    2247B    1191
```

```
      SUBROUTINE LINTRP(X,XT,YT,NX,NL,RA,Y,NERR)
      DIMENSION XT(1),YT(1)
      NERR=0
      IF((NL.GE.1).AND.(NL.LT.NX)) GO TO 10
C          INITIALIZE NL AND RA
      NL=1
      RA=(YT(2)-YT(1))/(XT(2)-XT(1))
C
   10 IF(X.GE.XT(NL)) GO TO 30
C          NL IS TOO LARGE
   20 IF(NL.EQ.1) GO TO 60
      NL=NL-1
      IF(X.LT.XT(NL)) GO TO 20
      RA=(YT(NL+1)-YT(NL))/(XT(NL+1)-XT(NL))
      GO TO 50
C
   30 IF(X.LE.XT(NL+1)) GO TO 50
C          NL IS TOO SMALL
   40 IF(NL.EQ.NX-1) GO TO 70
      NL=NL+1
      IF(X.GT.XT(NL+1)) GO TO 40
      RA=(YT(NL+1)-YT(NL))/(XT(NL+1)-XT(NL))
C
   50 Y=YT(NL)+RA*(X-XT(NL))
      RETURN
C          X IS LESS THAN XT(1)
   60 NERR=1
      Y=YT(1)
      RETURN
C          X IS GREATER THAN XT(NX)
   70 NERR=2
      Y=YT(NX)
      RETURN
      END
```

```
      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  LINTRP

VARIABLES      SN  TYPE        RELOCATION
    0  NERR        INTEGER           F.P.         0  NL      INTEGER                F.P.
    0  NX          INTEGER           F.P.         0  RA      REAL                   F.P.
    0  X           REAL              F.P.         0  XT      REAL        ARRAY      F.P.
    0  Y           REAL              F.P.         0  YT      REAL        ARRAY      F.P.

STATEMENT LABELS
   20  10                             24  20                         37  30
   43  40                             56  50                         65  60
   71  70

STATISTICS
  PROGRAM LENGTH           76B     62
```

```
      FUNCTION HWFLOT(INPUT)
      DATA IVLMSK/37777B/,CONVRT/.000061038881/,ISMSK/40000B/
      INTER=AND(IVLMSK,INPUT)
      ISGN=AND(ISMSK,INPUT)
      IF(ISGN.EQ.0)GO TO 10
      ISGN=-1
      INTER=COMPL(INTER)
      INTER=AND(IVLMSK,INTER)
      GO TO 20
   10 ISGN=1
   20 REAL=INTER*CONVRT
      HWFLOT=REAL*ISGN
      RETURN
      END
```

```
        SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     4   HWFLOT

 VARIABLES      SN  TYPE            RELOCATION
    23  CONVRT     REAL                                   25  HWFLOT     REAL
     0  INPUT      INTEGER               F.P.             26  INTER      INTEGER
    27  ISGN       INTEGER                                24  ISMSK      INTEGER
    22  IVLMSK     INTEGER                                30  REAL       REAL

 INLINE FUNCTIONS   TYPE    ARGS
        AND        NO TYPE    2  INTRIN                   COMPL      NO TYPE    1  INTRIN

 STATEMENT LABELS
    14  10                                 15  20

 STATISTICS
   PROGRAM LENGTH                  31B       25
```

```
RTREE MAIN(0),REALT(1)
GLOBAL COMA,COMM
END
```

```
*MAIN
 ?
 ?_REALT
READING FILE       LGO
           PROGRAM    MAIN     L=011417  BLOCKS  COMA     CM002215  COMB     CM000015  MANEUV   CM010334  GTARG    CM000013
                                         BLOCKS  COMP     CM000111  EXTRA    CM000110  ANG      CM000004  PK       CM000242
                                         BLOCKS  MISD     CM000016  DELT     CM000454  COMD     CM000005
           PROGRAM    ONE      L=000000  BLOCKS  MANEUV   CM010334
           PROGRAM    TWO      L=000000  BLOCKS  MANEUV   CM010334
           PROGRAM    THREE    L=000000  BLOCKS  COMA     CM002215  PK       CM000242  MANEUV   CM010334
           PROGRAM    INIT     L=001033  BLOCKS  EXTRA    CM000110  COMA     CM002215  COMB     CM000015  COMP     CM000111
                                         BLOCKS  MANEUV   CM010334  GTARG    CM000013
           PROGRAM    LETH     L=000617  BLOCKS  PK       CM000242  MISD     CM000016  MANEUV   CM010334  DELT     CM000454
                                         BLOCKS  GTARG    CM000013  COMD     CM000005  COMP     CM000111
           PROGRAM    GCLIM    L=000056  BLOCKS  COMP     CM000111
           PROGRAM    GUID     L=000021  BLOCKS  ANG      CM000004  COMB     CM000015
           PROGRAM    KSCALE   L=000362  BLOCKS  COMA     CM002215  COMP     CM000111
           PROGRAM    PRIME    L=000435  BLOCKS  COMA     CM002215  MANEUV   CM010334  ANG      CM000004  DELT     CM000454
                                         BLOCKS  COMB     CM000015  MU       CM000006  MISD     CM000016  COMP     CM000111
           PROGRAM    MISCOM   L=000773  BLOCKS  MISD     CM000016  DELT     CM000454  MU       CM000005  COMB     CM000015
                                         BLOCKS  MANEUV   CM010334  COMA     CM002215  GTARG    CM000013  COMD     CM000005
                                         BLOCKS  COMP     CM000111  EXTRA    CM000110
           PROGRAM    MEAN     L=000321  BLOCKS  COMP     CM000111
           PROGRAM    INTERP   L=000204
           PROGRAM    FLIGHT   L=000746  BLOCKS  COMA     CM002215  COMM     CM000032
           PROGRAM    REALT    L=001022  BLOCKS  COMA     CM002215  COMM     CM000032
           PROGRAM    LINTRP   L=000076
           PROGRAM    HWFLOT   L=000031
CONSULTING LIBRARY FORTRAN
           PROGRAM    FORSYS=  L=000645  BLOCKS  Q8.IO.   CM000134
           PROGRAM    SINCOS=  L=000071
           PROGRAM    ACOSIN=  L=000113
           PROGRAM    ATAN2    L=000100
           PROGRAM    SQRT     L=000044
           PROGRAM    OUTC=    L=000165  BLOCKS  IOCON.   CM000042  Q8.IO.   CM000134
           PROGRAM    INPC=    L=000164  BLOCKS  IOCON.   CM000042  Q8.IO.   CM000134
           PROGRAM    SIMSTOP  L=000006
           PROGRAM    ATAN     L=000065
           PROGRAM    ALOG     L=000073
           PROGRAM    EXP      L=000076
           PROGRAM    SIMIDLE  L=000011
           PROGRAM    GOTOER=  L=000014
           PROGRAM    ITOJ=    L=000016
           PROGRAM    BHOLD    L=000011
           PROGRAM    NAMOUT=  L=000600  BLOCKS  IO.BUF.  CM000227
           PROGRAM    SIMRUN   L=000016
           PROGRAM    INTCNVT  L=000010
           PROGRAM    RESERVE  L=000012
           PROGRAM    PAUSE=   L=000025
           PROGRAM    PATSTAT  L=000023
           PROGRAM    SYSAID=  L=000001
           PROGRAM    SYS=AID  L=000053
           PROGRAM    FMTAP=   L=003345  BLOCKS  IOCON.   CM000042  Q8.IO.   CM000134
           PROGRAM    GETFIT=  L=000034
           PROGRAM    SIMERR.  L=000015
           PROGRAM    GETHF    L=000015
           PROGRAM    COMIO=   L=000362  BLOCKS  Q8.IO.   CM000134  IOCON.   CM000042
           PROGRAM    KODER=   L=000460  BLOCKS  IOCON.   CM000042  Q8.IO.   CM000134
           PROGRAM    KRAKER=  L=000414  BLOCKS  IOCON.   CM000042  Q8.IO.   CM000134
           PROGRAM    OUTCOM=  L=000141  BLOCKS  Q8.IO.   CM000134  IOCON.   CM000042
```

```
 PROGI   FLT      L=01      BL      QB.      CM0        IC        CM      2
 PROGRAM INCOM=   L=000252  BLOCKS  Q8.IO.   CM000134   IOCON.    CM000042
 PROGRAM FLTIN=   L=000153  BLOCKS  Q8.IO.   CM000134   IOCON.    CM000042
CONSULTING LIBRARY SYSIO
 PROGRAM OPEN.SQ  L=000260  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  JMPS.RM CM000011  OPEN.FO CM000007
 PROGRAM OPEN.RM  L=000235  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  JMPS.RM CM000011  MEMC.RM CM000003
                            BLOCKS  OPES.FO  CM000001   OPEN.FO   CM000007
 PROGRAM PUT.SQ   L=001227  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  PUT.FO  CM000007  JMPS.RM CM000011
 PROGRAM CLSF.RM  L=000023  BLOCKS  CLSF.FO  CM000007
 PROGRAM Z.SQ     L=000101  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  GET.RT  CM000011
 PROGRAM SKFL.SQ  L=000047  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  SKFL.FO CM000007
 PROGRAM SYS.RM   L=000051
 PROGRAM LXER.SQ  L=000210  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  JMPS.RM CM000011
 PROGRAM BTRT.SQ  L=000114  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  GET.BT  CM000005
 PROGRAM GET.SQ   L=000777  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  GET.FO  CM000007  GET.BT  CM000005
                            BLOCKS  GET.RT   CM000011
 PROGRAM CHMR.SQ  L=000007  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006
 PROGRAM CIO.RM   L=000042  BLOCKS  CON.RM   CM000006
 PROGRAM ERR.RM   L=000400  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006
 PROGRAM MCT.RM   L=000233
 PROGRAM OSUB.RM  L=000067  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006
 PROGRAM CLSV.SQ  L=000131  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  JMPS.RM CM000011  CLSV.FO CM000007
 PROGRAM LBUF.SQ  L=000133  BLOCKS  JMPS.RM  CM000011
 PROGRAM RTRCL    L=000030
 PROGRAM OPEX.SQ  L=000015  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006
 PROGRAM CLSF.SQ  L=000131  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  JMPS.RM CM000011  CLSF.FO CM000007
 PROGRAM MOVE.RM  L=000064  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006
 PROGRAM RLEQ.RM  L=000042  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  PUT.RT  CM000011
 PROGRAM FSU.SQ   L=000110  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006  GET.RT  CM000011
 PROGRAM WAR.SQ   L=000256  BLOCKS  AOB.RM   CM000010   CON.RM    CM000006

>>>>>>>>> SEGMENT   MAIN        FWA =        +001104 EXEC.FWA=   +001104  LWA+1=   +050731
   *** BLOCK NAME..TYPE........FWA.......LENGTH
 MAIN       PROGRAM     +001104   0011417
 ONE        PROGRAM     +012523   0000000
 TWO        PROGRAM     +012523   0000000
 THREE      PROGRAM     +012523   0000000
 INIT       PROGRAM     +012523   0001033
 LETH       PROGRAM     +013556   0000617
 QCLIM      PROGRAM     +014375   0000056
 GUID       PROGRAM     +014453   0000021
 KSCALE     PROGRAM     +014474   0000362
 PRINE      PROGRAM     +015056   0000435
 MISCOM     PROGRAM     +015513   0000773
 MEAN       PROGRAM     +016506   0000321
 INTERP     PROGRAM     +017027   0000204
 FLIGHT     PROGRAM     +017233   0000746
 FORSYS=    PROGRAM     +020201   0000645
 SINCOS=    PROGRAM     +021046   0000071
 ACOSIN=    PROGRAM     +021137   0000113
 ATAN2      PROGRAM     +021252   0000100
 SQRT       PROGRAM     +021352   0000044
 OUTC=      PROGRAM     +021416   0000165
 INPC=      PROGRAM     +021603   0000164
 DHOLD      PROGRAM     +021767   0000011
 NAMOUT=    PROGRAM     +022000   0000600
 SIMRUN     PROGRAM     +022600   0000016
 INTCNVT    PROGRAM     +022616   0000010
 RESERVE    PROGRAM     +022626   0000012
 PAUSE=     PROGRAM     +022640   0000025
 PATSTAT    PROGRAM     +022665   0000023
 SYSAID=    PROGRAM     +022710   0000001
 SYS=AID    PROGRAM     +022711   0000053
 FMTAP=     PROGRAM     +022764   0000345
 GETFIT=    PROGRAM     +023331   0000034
 GETHF      PROGRAM     +023365   0000015
```

COMIO=	PROGRAM	+023402	0000062
KODER=	PROGRAM	+023464	0000460
KRAKER=	PROGRAM	+024144	0000414
OUTCOM=	PROGRAM	+024560	0000141
FLTOUT=	PROGRAM	+024721	0000310
INCOM=	PROGRAM	+025231	0000262
FLTIN=	PROGRAM	+025513	0000153
OPEN.SQ	PROGRAM	+025666	0000260
OPEN.RM	PROGRAM	+026146	0000235
PUT.SQ	PROGRAM	+026403	0001227
CLSF.RM	PROGRAM	+027632	0000023
Z.SQ	PROGRAM	+027655	0000101
SKFL.SQ	PROGRAM	+027756	0000047
SYS.RM	PROGRAM	+030025	0000051
LXER.SQ	PROGRAM	+030076	0000210
BTRT.SQ	PROGRAM	+030306	0000114
GET.SQ	PROGRAM	+030422	0000777
CHWR.SQ	PROGRAM	+031421	0000007
CIO.RM	PROGRAM	+031430	0000042
ERR.RM	PROGRAM	+031472	0000400
MCT.RM	PROGRAM	+032072	0000233
OSUB.RM	PROGRAM	+032325	0000067
CLSV.SQ	PROGRAM	+032414	0000131
LBUF.SQ	PROGRAM	+032545	0000133
RTRCL	PROGRAM	+032700	0000030
OPEX.SQ	PROGRAM	+032730	0000015
CLSF.SQ	PROGRAM	+032745	0000131
MOVE.RM	PROGRAM	+033076	0000064
RLEQ.RM	PROGRAM	+033162	0000042
FSU.SQ	PROGRAM	+033224	0000110
WAR.SQ	PROGRAM	+033334	0000256
ATAN	PROGRAM	+033612	0000065
ALOG	PROGRAM	+033677	0000073
EXP	PROGRAM	+033772	0000075
GOTOER=	PROGRAM	+034070	0000014
SIMERR.	PROGRAM	+034104	0000015
PUT.RT	COMMON	+034121	0000011
CLSV.FO	COMMON	+034132	0000007
GET.FO	COMMON	+034141	0000007
GET.BT	COMMON	+034150	0000005
SKFL.FO	COMMON	+034155	0000007
GET.RT	COMMON	+034164	0000011
CLSF.FO	COMMON	+034175	0000007
PUT.FO	COMMON	+034204	0000007
OPES.FO	COMMON	+034213	0000001
MEMC.RM	COMMON	+034214	0000003
OPEN.FO	COMMON	+034217	0000007
JMPS.RM	COMMON	+034226	0000011
CON.RM	COMMON	+034237	0000005
AGH.RM	COMMON	+034245	0000010
IO.BUF.	COMMON	+034255	0000227
IOCON.	COMMON	+034504	0000042
Q8.IO.	COMMON	+034546	0000134
MU	COMMON	+034702	0000006
COMD	COMMON	+034710	0000005
DELT	COMMON	+034715	0000454
MISJ	COMMON	+035371	0000015
PK	COMMON	+035407	0000242
ANG	COMMON	+035651	0000004
EXTRA	COMMON	+035655	0000110
COMP	COMMON	+035765	0000111
GTARG	COMMON	+036076	0000013
MANEUV	COMMON	+036111	0010334
COMB	COMMON	+046445	0000015
COMM	GLOBAL	+046462	0000032
COMA	GLOBAL	+046514	0002215

```
>>>>>>>>> SEGMENT  REALT        FWA =        +050731 EXEC.FWA=    +050731  LWA+1=  +062053
    ***  BLOCK NAME..TYPE........FWA.......LENGTH
         REALT       PROGRAM     +050731   0001022
         LINTRP      PROGRAM     +051753   0000076
         HWFLOT      PROGRAM     +052051   0000031
         SIMSTOP     PROGRAM     +052102   0000006
         ATAN        PROGRAM     +052110   0000065
         ALOG        PROGRAM     +052175   0000073
         EXP         PROGRAM     +052270   0000076
         SIMIDLE     PROGRAM     +052366   0000011
         GOTOER=     PROGRAM     +052377   0000014
         ITOJ=       PROGRAM     +052413   0000016
         SIMERR.     PROGRAM     +052431   0000015
         ACOSIN=     PROGRAM     +052446   0000113
         SINCOS=     PROGRAM     +052561   0000071
         SQRT        PROGRAM     +052652   0000044
         SYS.RM      PROGRAM     +052716   0000051
         SYS=AID     PROGRAM     +052767   0000053
         FORSYS=     PROGRAM     +053042   0000645
         SYSAID=     PROGRAM     +053707   0000001
         OPEN.SQ     PROGRAM     +053710   0000260
         OPEN.RM     PROGRAM     +054170   0000235
         PUT.SQ      PROGRAM     +054425   0001227
         CLSF.RM     PROGRAM     +055654   0000023
         Z.SQ        PROGRAM     +055677   0000101
         SKFL.SQ     PROGRAM     +056000   0000047
         LXER.SQ     PROGRAM     +056047   0000210
         BTRT.SQ     PROGRAM     +056257   0000114
         ERR.RM      PROGRAM     +056373   0000400
         CIO.RM      PROGRAM     +056773   0000042
         CLSF.SQ     PROGRAM     +057035   0000131
         OPEX.SQ     PROGRAM     +057166   0000015
         CHWR.SQ     PROGRAM     +057203   0000007
         OSUB.RM     PROGRAM     +057212   0000067
         MCT.RM      PROGRAM     +057301   0000233
         RTRSL       PROGRAM     +057534   0000030
         CLSV.SQ     PROGRAM     +057564   0000131
         MOVE.RM     PROGRAM     +057715   0000064
         RLEQ.RM     PROGRAM     +060001   0000042
         WAR.SQ      PROGRAM     +060043   0000256
         GET.SQ      PROGRAM     +060321   0000777
         LBUF.SQ     PROGRAM     +061320   0000133
         FSU.SQ      PROGRAM     +061453   0000110
         GET.FO      COMMON      +061563   0000007
         PUT.RT      COMMON      +061572   0000011
         CLSV.FO     COMMON      +061603   0000007
         GET.BT      COMMON      +061612   0000005
         SKFL.FO     COMMON      +061617   0000007
         GET.RT      COMMON      +061626   0000011
         CLSF.FO     COMMON      +061637   0000007
         PUT.FO      COMMON      +061646   0000007
         OPES.FO     COMMON      +061655   0000001
         MEMC.RM     COMMON      +061656   0000003
         OPEN.FO     COMMON      +061661   0000007
         JMPS.RM     COMMON      +061670   0000011
         CON.RM      COMMON      +061701   0000006
         ADB.RM      COMMON      +061707   0000010
         Q8.IO.      COMMON      +061717   0000134
    ***  FN.GLOBAL..SEGMENT...SAFETY......FWA
         COMM        MAIN        SAFE      +046462
         COMA        MAIN        SAFE      +046514
******** CM BLANK COMMON FWA=    +062053  LWA+1=  +062053
```

```
IS1 =     0     NSAM =     2     ICON =     2     INL =     2

CLMS =    3.75000     CLS1 =    0.00000     CLS2 =    3.26700
CLMS =    2.39400     CLS1 =    0.00000     CLS2 =    2.56800
CLMS =    1.88000     CLS1 =    0.00000     CLS2 =    2.26600
CLMS =    1.59600     CLS1 =    0.00000     CLS2 =    2.08900
CLMS =    1.41000     CLS1 =     .03000     CLS2 =    1.97000
CLMS =    1.27700     CLS1 =     .11800     CLS2 =    1.88200
CLMS =    1.17500     CLS1 =     .18500     CLS2 =    1.81500
CLMS =    1.09400     CLS1 =     .23900     CLS2 =    1.76100
CLMS =    1.02800     CLS1 =     .28400     CLS2 =    1.71600
CLMS =     .97300     CLS1 =     .32200     CLS2 =    1.67800

Q1 =    0.00000     Q2 =    0.00000     Q3 =    0.00000     Q4 =    0.00000     Q5 =    0.00000     Q6 =    0.00000

W1 =    0.00000     W2 =    0.00000     W3 =    0.00000     W4 =    0.00000     W5 =    0.00000     W6 =    0.00000

NRUNS =     1

NPTS =    10     DX =    20.00000     XTERM =   100.00000

NL =    59

      TABLE OF LAUNCH CONDITIONS


      SET  1     ALTITUDE = 11482.90   FT   CROSSING ANGLE = 323.00   DEG   INITIAL RANGE =  13123.40   FT
      SET  2     ALTITUDE =  2624.70   FT   CROSSING ANGLE = 285.00   DEG   INITIAL RANGE =   2952.80   FT
      SET  3     ALTITUDE = 11482.90   FT   CROSSING ANGLE =  38.00   DEG   INITIAL RANGE =  13123.40   FT
      SET  4     ALTITUDE =  1312.30   FT   CROSSING ANGLE = 338.00   DEG   INITIAL RANGE =   6561.70   FT
      SET  5     ALTITUDE =  3280.80   FT   CROSSING ANGLE = 315.00   DEG   INITIAL RANGE =   8202.10   FT
      SET  6     ALTITUDE =  3280.80   FT   CROSSING ANGLE = 300.00   DEG   INITIAL RANGE =   9842.50   FT
      SET  7     ALTITUDE =  3280.80   FT   CROSSING ANGLE =  60.00   DEG   INITIAL RANGE =   9842.50   FT
      SET  8     ALTITUDE =  2296.60   FT   CROSSING ANGLE =  45.00   DEG   INITIAL RANGE =   4921.30   FT
      SET  9     ALTITUDE =  1312.30   FT   CROSSING ANGLE =  23.00   DEG   INITIAL RANGE =   3608.90   FT
      SET 10     ALTITUDE =  1312.30   FT   CROSSING ANGLE =  10.00   DEG   INITIAL RANGE =   3608.90   FT
      SET 11     ALTITUDE =  1312.30   FT   CROSSING ANGLE = 350.00   DEG   INITIAL RANGE =   3937.00   FT
      SET 12     ALTITUDE =  2296.60   FT   CROSSING ANGLE =   0.00   DEG   INITIAL RANGE =   6233.60   FT
      SET 13     ALTITUDE =  1968.50   FT   CROSSING ANGLE = 355.00   DEG   INITIAL RANGE =   7545.90   FT
      SET 14     ALTITUDE =  1640.40   FT   CROSSING ANGLE = 345.00   DEG   INITIAL RANGE =   9842.50   FT
      SET 15     ALTITUDE =  1640.40   FT   CROSSING ANGLE = 338.00   DEG   INITIAL RANGE =   4921.30   FT
      SET 16     ALTITUDE =  2296.60   FT   CROSSING ANGLE = 210.00   DEG   INITIAL RANGE =   2624.70   FT
      SET 17     ALTITUDE =   328.10   FT   CROSSING ANGLE = 195.00   DEG   INITIAL RANGE =   2624.70   FT
      SET 18     ALTITUDE =   328.10   FT   CROSSING ANGLE = 165.00   DEG   INITIAL RANGE =   2624.70   FT
      SET 19     ALTITUDE =  2296.60   FT   CROSSING ANGLE = 150.00   DEG   INITIAL RANGE =   2624.70   FT
      SET 20     ALTITUDE =   196.80   FT   CROSSING ANGLE =  38.00   DEG   INITIAL RANGE =   4921.30   FT
      SET 21     ALTITUDE =  1640.40   FT   CROSSING ANGLE =  23.00   DEG   INITIAL RANGE =   4921.30   FT
```

```
SET [illegible]   ALTITUDE = 164[illegible] FT   CROSSING ANGLE =   5.00  DEG   INITIAL RANGE = [illegible]1.70  FT
SET [illegible]   ALTITUDE = 1968.50  FT   CROSSING ANGLE =   5.00  DEG   INITIAL RANGE =  7217.80  FT
SET 24   ALTITUDE =  984.20  FT   CROSSING ANGLE = 350.00  DEG   INITIAL RANGE =  4921.30  FT
SET 25   ALTITUDE =  492.10  FT   CROSSING ANGLE = 330.00  DEG   INITIAL RANGE =  5577.40  FT
SET 26   ALTITUDE = 1312.30  FT   CROSSING ANGLE = 330.00  DEG   INITIAL RANGE =  6561.70  FT
SET 27   ALTITUDE = 1640.40  FT   CROSSING ANGLE = 330.00  DEG   INITIAL RANGE = 11482.90  FT
SET 28   ALTITUDE = 1968.50  FT   CROSSING ANGLE = 330.00  DEG   INITIAL RANGE =  5577.40  FT
SET 29   ALTITUDE =  492.10  FT   CROSSING ANGLE = 240.00  DEG   INITIAL RANGE =  2624.70  FT
SET 30   ALTITUDE =  492.10  FT   CROSSING ANGLE = 225.00  DEG   INITIAL RANGE =  2624.70  FT
SET 31   ALTITUDE =  196.80  FT   CROSSING ANGLE = 180.00  DEG   INITIAL RANGE =  2624.70  FT
SET 32   ALTITUDE = 1640.40  FT   CROSSING ANGLE = 180.00  DEG   INITIAL RANGE =  2624.70  FT
SET 33   ALTITUDE =  492.10  FT   CROSSING ANGLE = 135.00  DEG   INITIAL RANGE =  2624.70  FT
SET 34   ALTITUDE =  196.80  FT   CROSSING ANGLE =  75.00  DEG   INITIAL RANGE = 11482.90  FT
SET 35   ALTITUDE =  196.80  FT   CROSSING ANGLE =  38.00  DEG   INITIAL RANGE =  5905.50  FT
SET 36   ALTITUDE = 1968.50  FT   CROSSING ANGLE =  30.00  DEG   INITIAL RANGE =  5577.40  FT
SET 37   ALTITUDE = 1640.40  FT   CROSSING ANGLE =  30.00  DEG   INITIAL RANGE =  5577.40  FT
SET 38   ALTITUDE = 1312.30  FT   CROSSING ANGLE =  30.00  DEG   INITIAL RANGE =  6561.70  FT
SET 39   ALTITUDE =  984.20  FT   CROSSING ANGLE =  10.00  DEG   INITIAL RANGE =  4265.10  FT
SET 40   ALTITUDE = 1968.50  FT   CROSSING ANGLE = 345.00  DEG   INITIAL RANGE =  4921.30  FT
SET 41   ALTITUDE = 1968.50  FT   CROSSING ANGLE = 338.00  DEG   INITIAL RANGE =  4921.30  FT
SET 42   ALTITUDE =  492.10  FT   CROSSING ANGLE = 323.00  DEG   INITIAL RANGE =  5577.40  FT
SET 43   ALTITUDE =  196.80  FT   CROSSING ANGLE = 323.00  DEG   INITIAL RANGE =  5577.40  FT
SET 44   ALTITUDE = 1312.30  FT   CROSSING ANGLE = 315.00  DEG   INITIAL RANGE =  5577.40  FT
SET 45   ALTITUDE =  328.10  FT   CROSSING ANGLE = 315.00  DEG   INITIAL RANGE =  5577.40  FT
SET 46   ALTITUDE = 2296.60  FT   CROSSING ANGLE = 270.00  DEG   INITIAL RANGE =  4921.30  FT
SET 47   ALTITUDE = 1640.40  FT   CROSSING ANGLE = 195.00  DEG   INITIAL RANGE =  2624.70  FT
SET 48   ALTITUDE = 1640.40  FT   CROSSING ANGLE = 165.00  DEG   INITIAL RANGE =  6561.70  FT
SET 49   ALTITUDE = 1640.40  FT   CROSSING ANGLE =  90.00  DEG   INITIAL RANGE =  4921.30  FT
SET 50   ALTITUDE = 1312.30  FT   CROSSING ANGLE =  45.00  DEG   INITIAL RANGE =  5577.40  FT
SET 51   ALTITUDE =  328.10  FT   CROSSING ANGLE =  45.00  DEG   INITIAL RANGE =  5577.40  FT
SET 52   ALTITUDE = 2296.60  FT   CROSSING ANGLE =  30.00  DEG   INITIAL RANGE =  5577.40  FT
SET 53   ALTITUDE = 1968.50  FT   CROSSING ANGLE =  23.00  DEG   INITIAL RANGE =  5577.40  FT
SET 54   ALTITUDE = 1968.50  FT   CROSSING ANGLE =  15.00  DEG   INITIAL RANGE =  4921.30  FT
SET 55   ALTITUDE =  328.10  FT   CROSSING ANGLE =   0.00  DEG   INITIAL RANGE =  6561.70  FT
SET 56   ALTITUDE =  492.10  FT   CROSSING ANGLE = 338.00  DEG   INITIAL RANGE =  5577.40  FT
SET 57   ALTITUDE =  328.10  FT   CROSSING ANGLE = 180.00  DEG   INITIAL RANGE =  2624.70  FT
SET 58   ALTITUDE =  492.10  FT   CROSSING ANGLE = 180.00  DEG   INITIAL RANGE =  4921.30  FT
SET 59   ALTITUDE = 3437.90  FT   CROSSING ANGLE =  53.06  DEG   INITIAL RANGE =  8835.00  FT
SET 60   ALTITUDE = 3281.00  FT   CROSSING ANGLE =  45.00  DEG   INITIAL RANGE =  9843.00  FT

III =     0     IRSS =     1     KA =    60     ITT =    39     NOGO =     1

TAU =    0.00000

PSI LAUNCH = 315.00 DEG       THETA LAUNCH = 19.47 DEG       INITIAL RANGE =  9843.00 FT
XTEO =  6551.99 FT       YTEO =  -6552.01 FT       ZTEO =  -3281.00 FT
T-PRIME =    4.4700 SEC      DELTAR AT 1000 FT TO GO =    6749.50 FT
T AT GAMA MIN OVERLOAD =      1.9452 SEC
DELTAR AT GAMA MIN OVERLOAD =      1875.8 FT
VM AT GAMA MIN OVERLOAD =      1906.2 FT/SEC
GAMA =      4.3570
SMALLEST BIT A/D RESOLUTION =        .0896    FT
NPTS = 10      DX = 20.00 FT      XTERM = 100.00 FT

RANGE-TO-GO TABLE FOR DATA COLLECTION

            RANGE,FT       SCALED RANGE
```

280.00	-.28000000E+03
260.00	-.26000000E+03
240.00	-.24000000E+03
220.00	-.22000000E+03
200.00	-.20000000E+03
180.00	-.18000000E+03
160.00	-.16000000E+03
140.00	-.14000000E+03
120.00	-.12000000E+03
100.00	-.10000000E+03

XDTEO = 0.00 FT/SEC   YDTEO = 1013.40 FT/SEC   ZDTEO = 0.00 FT/SEC
XDTLO = -675.60 FT/SEC   YDTLO = 716.58 FT/SEC   ZDTLQ = -238.86 FT/SEC
CROSSING ANGLE = 45.00 DEG   DIVE ANGLE = 0.00 DEG

EARTH FIXED COORDINATES

TIME	XD MANEUVER	YD MANEUVER	ZD MANEUVER
0.0000	0.00	1013.40	0.00
1.0000	0.00	1013.40	0.00
2.0000	0.00	1013.40	0.00
3.0000	0.00	1013.40	0.00
4.0000	0.00	1013.40	0.00
5.0000	0.00	1013.40	0.00
6.0000	0.00	1013.40	0.00
7.0000	0.00	1013.40	0.00
8.0000	0.00	1013.40	0.00
9.0000	0.00	1013.40	0.00
10.0000	0.00	1013.40	0.00
11.0000	0.00	1013.40	0.00
12.0000	0.00	1013.40	0.00
13.0000	0.00	1013.40	0.00
14.0000	0.00	1013.40	0.00
15.0000	0.00	1013.40	0.00
16.0000	0.00	1013.40	0.00
17.0000	0.00	1013.40	0.00
18.0000	0.00	1013.40	0.00
19.0000	0.00	1013.40	0.00
20.0000	0.00	1013.40	0.00
21.0000	0.00	1013.40	0.00
22.0000	0.00	1013.40	0.00
23.0000	0.00	1013.40	0.00
24.0000	0.00	1013.40	0.00
25.0000	0.00	1013.40	0.00
26.0000	0.00	1013.40	0.00

LAUNCH COORDINATES

TIME	XD MANEUVER	YD MANEUVER	ZD MANEUVER
0.0000	-675.60	716.58	-238.86
1.0000	-675.60	716.58	-238.86
2.0000	-675.60	716.58	-238.86
3.0000	-675.60	716.58	-238.86
4.0000	-675.60	716.58	-238.86
5.0000	-675.60	716.58	-238.86
6.0000	-675.60	716.58	-238.86
7.0000	-675.60	716.58	-238.86
8.0000	-675.60	716.58	-238.86
9.0000	-675.60	716.58	-238.86

00	75.6	.58	-2
11.0000	-675.60	716.58	-238.86
12.0000	-675.60	716.58	-238.86
13.0000	-675.60	716.58	-238.86
14.0000	-675.60	716.58	-238.86
15.0000	-675.60	716.58	-238.86
16.0000	-675.60	716.58	-238.86
17.0000	-675.60	716.58	-238.86
18.0000	-675.60	716.58	-238.86
19.0000	-675.60	716.58	-238.86
20.0000	-675.60	716.58	-238.86
21.0000	-675.60	716.58	-238.86
22.0000	-675.60	716.58	-238.86
23.0000	-675.60	716.58	-238.86
24.0000	-675.60	716.58	-238.86
25.0000	-675.60	716.58	-238.86
26.0000	-675.60	716.58	-238.86

RANDOM NUMBER IS .33689963E+01

```
TRUNK LINE PATCHING IS
          V13 TO W00
          V15 TO W13
          V60 TO W50
          V61 TO W50

RESERVATION ERROR CODE = 00000000000000000000

*REAL TIME STATUS = 00000000000000000000
```

```
      MICOM SCOPE 3.4.2 HY SM 48 MXN LEVEL 7C
14.29.51.RLPGS07  FROM     /G2
14.29.53.IP  00010496 WORDS - FILE INPUT   , DC 00
14.29.57.RLPGS,T100,CM140000,RT.
14.29.58.7437G13R00 7300  A3 PARKERL     J003
14.30.09.FTNH.
14.31.51.    19.125 CP SECONDS COMPILATION TIME
14.31.53.SEGLOAD.
14.31.53.LOAD(LGO)
14.31.53.NOGO.
14.33.24.RFL,65000.
14.33.24.ABS.
14.33.32.   PAUSE  GO TO RESERVE HYBRID EQUIPMENT
14.33.40.GO
14.33.41.   PAUSE  WAIT FOR SENSE LINE 5 HIGH
14.34.05.GO
14.34.05.   PAUSE  GO TO ENTER REAL TIME
14.34.38.GO
14.34.39.J03 013 ENTER REAL TIME
14.34.51.   PAUSE  SET SENSE LINE 0 LOW TO RESTAR
14.34.51.T A BAD RUN
14.36.34.GO
14.36.35.ERROR MODE = 4.  ADDRESS =016575
14.36.45.INT 09D-ET000000315326B
14.36.45.OP  00036992 WORDS - FILE OUTPUT , DC 77
14.36.45.MS   28672  WORDS  (  114688 MAX USED)
14.36.45.CPA      25.579 SEC.        23.023 ADJ.
14.36.45.IO       11.433 SEC.         6.496 ADJ.
14.36.45.CM      930.224 KWS.         9.461 ADJ.
14.36.45.PP       59.975 SEC.     DATE 01/12/76
14.36.45.EJ  END OF JOB, G2
```

APPENDIX C. CODE FOR TESTING ADCS AND DACS

B&K DYNAMICS, INC.

```
NAAGS,T10,CM70000,RT.
ACCT(PN=PARKERL.PBC=7487G13R00,CC=7300,OP=A3,JN=J002)
FTNH.
SEGLOAD.
LGO.
0000000000000000000000
      PROGRAM TRDISIO(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO CHECK DADIOS DISCRETES, THIS IS ACCOMPLISHED BY PATCHING
C     INPUT AND OUTPUT DISCRETE WORDS TOGETHER AT THE AD/4 LOGIC PANNEL
C     THE OUTPUT DISCRETE COUNTS UP CYCLICLY FROM 0 TO 2**16-1 AND THEN
C     BEGINS OVER WITH 0.
C
C     PROGRAM VARIABLES
C        IERR           ERROR CODE FOR RESERVATION
C                       0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT          REAL TIME MODE
C                       0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        IIDIS          CDC-6600 SENSE LINE DISCRETE(16 BIT)  IIDIS=IBACK
C        IODIS          CDC-6600 CONTROL LINE DISCRETE(16 BIT) IODIS=IOUT
C        MAXLINE        MAXIMUM LINES PER PAGE
C        MAXPAGE        MAXIMUM PAGES OF PRINTOUT
C        IOUT           A COUNTER WHICH PRODUCES OUTPUT FOR TESTING
C        LEN            NUMBER OF TRUNKING STATION CONNECTOR PAIRS USED
C        PIN(I)         I-TH TRUNCKING STATION CONNECTOR INPUT
C        POUT(I)        I-TH TRUNCKING STATION CONNECTOR OUTPUT
C
C     DADIOS PATCHING REQUIREMENTS (ONE IIDIS AND ONE IODIS)
C
C           TRUNKING               FORTRAN                   AD/4 PATCH
C        V-50 TO W-50      FOR /IDIS2/1,IIDIS      TR00-TR07 AND TR20-TR27
C        V-52 TO W-50      FOR /IDIS2/1,IIDIS      TR40-TR47 AND TR60-TR67
C        V-50 TO W-51      FOR /IDIS2/2,IIDIS      TR00-TR07 AND TR20-TR27
C        V-52 TO W-51      FOR /IDIS2/2,IIDIS      TR40-TR47 AND TR60-TR67
C
C        V-51 TO W-60      FOR /ODIS2/1,IODIS      TR10-TR17 AND TR30-TR37
C        V-53 TO W-60      FOR /ODIS2/1,IODIS      TR50-TR57 AND TR70-TR77
C        V-51 TO W-61      FOR /ODIS2/2,IODIS      TR10-TR17 AND TR30-TR37
C        V-53 TO W-61      FOR /ODIS2/2,IODIS      TR50-TR57 AND TR70-TR77
C
C
      INTEGER PIN(8),POUT(8)
      DIMENSION IBITIN(16),IBITOUT(16)
      COMMON/INTCOM/IOUT,LINE,MAXLINE,ISAVEIN(100)
      INTERRUPT(I=1,R=50,T=500,P=1000)
      COMMON/*IDIS2/1,IIDIS
      COMMON/*ODIS2/1,IODIS
C
C     INITIALIZATION
C
      IOUT=0
      LINE=0
      MAXLINE=60
      MAXPAGE=10
      IPAGE=0
      LEN=4
      PIN(1)=3RV50
      PIN(2)=3RV51
      PIN(3)=3RV52
```

```
      PIN(4)=3RV53
C
      CALL RESERVE(IERR)
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     CHECK PATCHING STATUS
C
      CALL PATSTAT(PIN,POUT,LEN)
      DO 10 I=1,LEN
   10 WRITE(6,8000)PIN(I),POUT(I)
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      CALL REMARK(17H JOB IN REAL TIME)
C
C
   25 CONTINUE
      CALL BHOLD
      LINE=0
      WRITE(6,5000)
      IPAGE=IPAGE+1
      IF(IPAGE.EQ.10)GO TO 20
      I1=IOUT-MAXLINE+1
C
      DO 30 I=I1,IOUT
      CALL BITS(I,IBITOUT)
      LINE=LINE+1
      IDUMY=ISAVEIN(LINE)
      CALL BITS(IDUMY,IBITIN)
   30 WRITE(6,4000)I,IBITOUT,IDUMY,IBITIN
      LINE=0
      CALL SIMGO
      GO TO 25
   20 WRITE(6,3000)
      CALL REMARK(15H RETURN TO MAIN)
      STOP
C
 1000 FORMAT(24H1RESERVATION ERROR CODE=,020)
 2000 FORMAT(18H REAL TIME STATUS=,020)
 3000 FORMAT(1H0,*PROGRAM TERMINATED NORMALLY*)
 4000 FORMAT(10X,I10,5X,16I1,5X,I10,5X,16I1)
 5000 FORMAT(1H1)
 8000 FORMAT(/*0TRUNK  LINE PATCHING IS *,R3,* TO *,R3)
      END
      SUBROUTINE SUB1
C
C     REAL TIME INTERRUPT SUBROUTINE
C
      COMMON/INTCOM/IOUT,LINE,MAXLINE,ISAVEIN(100)
      COMMON/*IDIS2/1,IIDIS
      COMMON/*ODIS2/1,IODIS
```

```
C
      IODIS=IOUT
      IN=IIDIS
      LINE=LINE+1
      ISAVEIN(LINE)=IN
      IF(IOUT.GE.2**16-1)IOUT=0
      IF(IOUT.LT.2**16-1)IOUT=IOUT+1
      IF(LINE.GE.MAXLINE)CALL SIMHOLD
      CALL SIMIDLE
      END
      SUBROUTINE BITS(IIN,IBIT)
C     PROGRAM TO CONVERT BASE TEN TO BITS
C
C     THE LEAST SIGNIFICANT BIT IS STORED IN BIT(1)
C
C     PROGRAM VARIBLES
C        IIN              A NUMBER BASE TEN
C        IBIT(I)          I-TH BIT OF A BINARY NUMBER
C        MAXBIT           MAXIMUM BITS CONVERTED IN INPUT SENSE LINE
C
      INTEGER OLDNUM
      DIMENSION IBIT(16)
      MAXBIT=16
      DO 1 I=1,MAXBIT
    1 IBIT(I)=0
      OLDNUM=IIN
      DO 2 I=1,MAXBIT
      NEWNUM=OLDNUM/2
      IBIT(I)=OLDNUM-2*NEWNUM
      OLDNUM=NEWNUM
    2 CONTINUE
      IHALF=MAXBIT/2
      DO 3 I=1,IHALF
      ITEMP=IBIT(I)
      IBIT(I)=IBIT(MAXBIT+1-I)
    3 IBIT(MAXBIT+1-I)=ITEMP
      RETURN
      END
0000000000000000000000
      RTREE TRDISIO(0),SUB1(1)
      GLOBAL INTCOM
      END
0000000000000000000000
0000000000000000000000
0000000000000000000000
```

```
NEEGS,T25,CM70000,RT.
ACCT(PN=PARKERL,PBC=7487G13R00,CC=7300,OP=A3,JN=J002)
FTNH.
SEGLOAD.
LGO.
0000000000000000000000
      PROGRAM TRALGIO(OUTPUT,HFILE,TAPE6=OUTPUT)
C
C     PROGRAM TO TEST ANALOG SIGNALS BETWEEN AD/4 AND CDC/6600. THIS TASK
C     IS ACCOMPLISHED BY TURNING THE ANALOG SIGNAL AROUND AT THE AD/4 AND
C     COMPAREING DIFFERENCE UPON RETURN TO THE CDC/6600. THE PROGRAM TEST
C     FOR ERRORS GREATER THAN FIVE PERCENT.
C
C     NOTE ADCS AND DACS ARE IN GROUPS OF 16, 1-16, 17-32, 33-48, 49-64.
C     FLOATING POINT ANALOG SIGNALS ARE SCALED GE -1.0 AND LE +1.0.
C     INTEGER ANALOG SIGNALS ARE SCALED GE -32767 AND LE +32767(14 BIT).
C
C     PROGRAM VARIABLES
C        IERR          ERROR CODE FOR RESERVATION
C                      0=NOERROR, GT.0=RESERVATION ERROR
C        ISTAT         REAL TIME MODE
C                      0=IN REAL TIME, ISTAT.GT.0 NOT IN REAL TIME
C        OUT           THE DAC VARIABLE
C        BACK          THE ADC VARIABLE
C        BIGDIFF       MAXIMUM ALLOWABLE DIFFERENCE IN ADC AND DAC
C        DIFF          ACTUAL COMPUTED DIFFERENCE IN ADC AND DAC
C        LINE          NUMBER OF LINES OF PRINTOUT IN EXECUTION
C        MAXLINE       MAXIMUM NUMBER OF LINES PRINTED
C        TIMELFT       REMAINING RCT TIME
C        STATUS        THE HRTM STATUS WORD
C        LOOP          NUMBER OF ATTEMPTS TO EQUATE ADC AND DAC
C        J             A MASKING  WORD USED IN COJUNCTION WITH THE
C                      STAT FUNCTION
C
C     DADIOS PATCHING REQUIREMENTS (AD/4 FIELD 3, 4TH GROUP ADC AND DAC)
C
C          TRUNKING                FORTRAN                   AD/4 PATCH
C        W-03 TO V-06       FOR /*ADC1/49,ADC         TR10-TR17 AND TR30-TR37
C        W-13 TO V-07       FOR /*DAC1/49,DAC         TR50-TR57 AND TR70-TR77
C
C     THE FIRST ADC IN EACH GROUP OF 16 CORRESPONDS TO AD/4 TR-10.
C     THE FIRST DAC IN EACH GROUP OF 16 CORRESPONDS TO AD/4 TR-50.
C
C
      COMMON/INTCOM/OUT,LOOP,BACK(16),BIGDIFF,DIFF(16),STATUS,J
      INTERRUPT(I=1,R=100,T=10000)
      COMMON/*ADC1/ 1,ADC(16)
      COMMON/*DAC1/ 1,DAC(16)
C
C     INITIALIZATION
C
      BIGDIFF=.001
      OUT=-1.5
      LOOP=0
      LINE=0
      MAXLINE=400
      IWRITE=0
      J=77777777777777777777B
      CALL RESERVE(IERR)
```

```
      WRITE(6,1000)IERR
      IF(IERR.NE.0)STOP
C
C     REAL TIME
C
      CALL SIMRUN(ISTAT)
      WRITE(6,2000)ISTAT
      CALL REMARK(17H JOB IN REAL TIME)
      WRITE(6,5000)
   25 CONTINUE
      CALL BHOLD
      LINE=LINE+1
      IF(LINE.GT.MAXLINE)GO TO 50
      TIMELFT=STATUS.A.37777777B
      WRITE(6,4000)OUT,BACK,LOOP
      WRITE(6,6000)DIFF
      OUT=OUT+0.01
      IF(OUT.GT.1.50)OUT=0.0
      LOOP=0
      CALL SIMGO
      GO TO 25
   50 WRITE(6,3000)
      STOP
 1000 FORMAT(24H1RESERVATION ERROR CODE=,O20)
 2000 FORMAT(18H REAL TIME STATUS=,O20)
 3000 FORMAT(1H0,*PROGRAM TERMINATED ON MAX LINE*)
 4000 FORMAT(1X,17F7.4,I3)
 5000 FORMAT(1H1)
 6000 FORMAT(8X,16F7.4)
      END
      SUBROUTINE SUB1
C
C     REAL TIME INTERRUPT SUBROUTINE
C
C
      COMMON/INTCOM/OUT,LOOP,BACK(16),BIGDIFF,DIFF(16),STATUS,J
      COMMON/*ADC1/ 1,ADC(16)
      COMMON/*DAC1/ 1,DAC(16)
      IERR=0
      DO 1 I=1,16
      DAC(I)=OUT
    1 BACK(I)=ADC(I)
C     COMPUTE DIFFERENCE IN ADC AND DAC VALUES
C
      DO 2 I=1,16
      DIFF(I)=ABS(OUT)-ABS(BACK(I))
      IF(ABS(DIFF(I)).GT.BIGDIFF)IERR=1
    2 CONTINUE
      IF(IERR.EQ.0)CALL SIMHOLD
      STATUS=STAT(J)
      LOOP=LOOP+1
      STATUS=STAT(J)
      IF(LOOP.EQ.10)CALL SIMHOLD
      CALL SIMIDLE
      END
0000000000000000000000
      RTREE TRALGIO(0),SUB1(1)
      GLOBAL INTCOM
      END
0000000000000000000000
0000000000000000000000
0000000000000000000000
```